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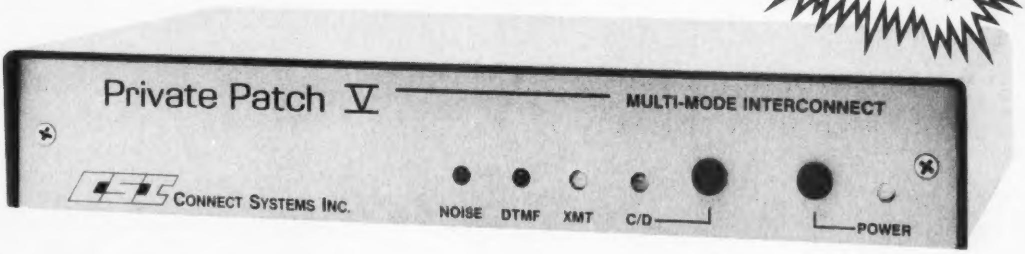

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LETTERS

From the Hamshack

Sam Taylor, Oroville CA: Your magazine is now and has always been the best amateur magazine because it has always had good construction projects. In the past there were priceless projects that are now lost in time. Keep up the construction projects because they help the availability of parts by creating a demand. (I am not a dealer but I do build a lot of projects that I pass on at cost to local hams.) If your editors would look back into those old issues they would find much that is still applicable to the state of the art. Maybe listening to high speed CW has affected my mind.

Les Delmarter WB6YIK, Terra Bella CA: What we need is an easier entry to amateur radio than the present Novice class license offers. The growth we are looking for in order to save amateur radio is going to come only from the kids, not the few engineers who would be attracted to the ARRL's Communicator license. Who would these people communicate with? The 220 MHz band will probably disappear soon, while the 440 MHz band is almost exclusively closed repeaters, control links and remote bases, and activity above 450 MHz is pretty sparse in most areas of the country. I think a Communicator Class license is a good idea, but it should fit into the current license structure. I feel that a Communicator class license that offered the current Novice voice privileges on 28.300–28.500 and 220 MHz and required nothing more than the current Novice written test would be very attractive to prospective amateurs. This license would be good for 10 years, renewable, and could be upgraded to Novice by simply passing the 5 wpm code test. No changes to the current Novice or Technician class license would be required. Let's keep things simple and give the kids a good reason to get involved in amateur radio.

Lawrence W. Joy WN8P, Olathe KS: Just read "Experimental Gaussmeter" and "Standard Magnetic Field Generator" in the June issue. The term gauss is deprecated. According to correct metric practice, and the way I learned magnetics, the terms to use are the weber (Wb) for magnetic flux and the tesla (T) for magnetic flux density.

Weak fields have *to be measured in gauss or milligauss—the Tesla is too large,* being 10^4 *gauss. Calibration points on my meter would require a lot of zeros. 50 gauss equals 0.005 Tesla, for example. Earth's magnetic field varies from about 1 to 10 gauss. The Tesla is used primarily to describe very strong magnetic fields in the laboratory. 10 Tesla (a fairly weak laboratory field) is equal to 100,000 gauss, which is why the Tesla is preferred when referring to strong fields. The above complaint is akin to suggesting that 20.01 µF be expressed in farads. . . J. Frank Brumbaugh KB4ZGC, author.*

Arthur S. Byram K0LKT, Pittsburg MO: I do not believe the interest of amateur radio is being served by the constant hammering on the subject of the wonders of NO CODE exams. Persons subjected to this constant complaint will be turned against code without even trying it. Like a child that hears others constantly saying that this or that is awful, the child will claim that they "hate that" even though they have never encountered it.

How many hams now operating mostly on CW had that in mind when they applied for a license? After having to learn the code, they found that it is a real enjoyable form of communication. Wayne is right that the method of learning the code has improved immensely, so what is the problem?

Without new blood in the CW portion of the bands, only the old-timers will occupy the frequency, giving commercial interests a great opportunity to file for the use of those frequencies.

I support the code system as well as paying a license fee so the FCC can do the job we expect them to do. Our country is not perfect, but it is the best in the world.

Doug Brown, Athens GA: I am a 20-year-old college student who, after 12 years of dreaming, just earned my Novice license. I am still delirious. I would like to say that all of the people in the Athens Radio Club were very friendly and helpful and genuinely interested in encouraging newcomers.

I would like to thank *73* for having excellent articles, especially entry-level articles. These are very helpful for anyone who is just starting.

Here is a little advice I would offer anyone trying to learn the code: If you have a computer, buy a practice program. They are cheap and thousands of times more effective than practice tapes, since you cannot memorize them.

Some news that may shock people: I attend one of the top journalism schools in the country. It has a heavy emphasis on radio and television. Not once has amateur radio ever been mentioned during a class. Ninety percent of my friends had never heard of ham radio before. The few who have heard of it have no idea what it actually is, but think I'm starting up a noncommercial broadcast station. I'm trying to spread the gospel, but how did things get this bad?

P.S. Does anyone have some REALLY cheap equipment a starving college kid could afford? (149A Mitchell Street, Athens CA 30605).

David T. Burr KK9L, Downers Grove IL: The recent DXpeditions by 3Y, 7O, and others have shown that hams are not the self-policing group they're expected to be. Most of the social misfits who intentionally QRM nets, DX operations, repeaters, and general QSOs MUST be known by some of the locals around them, yet nothing is done. Thus, the cuts in the FCC enforcement budget were predicated on a false assumption.

Unfortunately, there is an on-going RF spectrum crunch, and if the 99% of us who care about our hobby want to enjoy it down the road, something has to be done to show the FCC that we appreciate the PRIVILEGE of occupying our frequency space, as well as clean it up to make our operating enjoyable once again.

I am in favor of not only license fees for new licenses and renewals, but also an annual fee of $20–30 to maintain our licenses. This would put $10 million into the enforcement budget (after administrative expenses) and have obvious positive effects. It is ironic that the old geezers who fill these pages with complaints about what the no-code license will do to the "quality" of operators are the same ones who would be first to resist this proposal. Just about anyone who maintains any sort of station could afford this little fee, and those who claim poverty could simply send a copy of their 1040 to the FCC and the fee could be reduced or waived. Our hobby is changing and if we want to enjoy it in 10 years we cannot continue to stick our heads in the sand. Anyone out there want to help save our hobby?

Walter A.L. King N3EID, Hellertown PA: Everyone is saying or should be saying, "What should we do to get more people involved with amateur radio?" and it is being said so much that a lot of folks are getting turned off about the idea. I know I was until something happened here.

I have lots of grandchildren and when they visited they avoided my "radio shack." Three of the grandchildren are boys ages 6, 8 and 10. I got to thinking how I started with radio and then it hit me . . . a crystal set . . . I built it and used to lie in my bed at night and listen to WLW in Cincinnati, Ohio. Some nights the signals were so strong you could hear the music across my bedroom!

So I started looking around for parts for a crystal set. They aren't easy to locate. But I did find a source—The National Supply Division of the Boy Scouts of America. I ordered three sets, which came in a few days. They don't have a diode with a germanium crystal fused into it.

All three grandsons took time to build a set, with Granddad there to help. The big moment came and everything went according to plan. Now each has a set in his bedroom at home. Mother is happy because they can't blast her out of the house with this type of radio. When the boys visited recently, they asked to go into the radio shack. Then one asked when will I teach them Morse code!!! It is a start. You gotta get them when they are young.

You can buy the set from the National Supply Division, B.S.A. at (800) 323-0732. The Crystal Set Radio kit is catalog number M-1731 and the cost is only $5.96. They accept Mastercard and Visa. At that price, why not buy several for others?

What about the granddaughters? Many girl children get the message very early in life that when it comes to machines and technology, this is something they would not be interested in, and that they should stay out of the way, especially if something is being fixed . . . Linda KA1UKM

Al Mehner W7HP, Las Vegas NV: Wayne, we both share our love of ham radio. I have spent time in the U.S. Signal Corp, U.S. Army Air, U.S. Coast Guard, and U.S. Maritime SVC—most of it pounding brass. I have been shot at, bombed at, and torpedoed at. I have intercepted Kata Kana prior to WWII, sent a peacetime SOS, told an admiral to . . . .

I have lived a long and happy life which is now drawing to a close.

I owe it all to ham radio.

I could not care less about the code–no-code conflict, but what ham radio needs is quality, not quantity.

We need the kids as young as we can get 'em, the younger the better. One young inquiring mind is worth a dozen appliance operators.

My schoolteacher wife took a handful of my foreign QSLs to her classes and encouraged the kids to write to the stations. The kids were deluged with letters and pictures of other kids.

I don't know how many of our young can read or write, but am sure that some of them can.

If you would, ask your *73* readers to give or loan cards to interested teachers and perhaps become elmers, it just might help.

My elmer was W7BB Ed Stevens. He was killed while flying his own plane, about 1946.

James Whitfield N5GUI, Aledo TX: Your June '90 "de K6MH" column provided me with a possible link to information I have been seeking. Please pass the information along to Mike Nugent WB8GLQ.

I have a Radio Shack WP-2 laptop word processor and the Portable Disk Drive (same as used on the Model 100). The WP-2 instruction book tells how to load and run program files to use it like a "real computer," but I have found no software for it and have not found a way to create a program file in the word processor. Perhaps *Portable 100* magazine can help me. If not, can you refer me to a group or magazine that can?

The WP-2 is a nice, small, clean package that has an RS-232 interface for disk drive, and parallel printer port. Assuming the program problems are readily solved, it would make a great packet/portable component, and that would be a great article for *73*, even if the interface was a repeat of similar units for the Model 100.

For now, programs must be written on another system (a PC, for example), and then ported over. The WP-2 Service Manual (RS #26-3930) gives some—though hardly complete—programming information.

At least one company is developing application software (not yet released and non-ham anyway), but until someone develops a language interpreter, assembler, or compiler, there's no way to program on the WP-2 itself.

Some of the whiz-kids on CompuServe's Model 100 Forum (M100SIG) have been WP-2 hacking. Check out their special section for WP-2 messages and files. It's the most up-to-date source of info I know.

Portable 100 *magazine, which covers all Tandy laptops, thoroughly reviewed the WP-2 in November 1989. Advertisers offer 32K and 128K expansion RAM chips, software for easy file transfer between WP-2s and PCs or Macs, and a buyer's guide full of good info. A monthly WP-2 column starts soon, and a WP-2/packet article has been assigned. (I'll see if we can spin it off for* 73, *too.) Contact* Portable 100 *at P.O. Box 428, Peterborough NH 03458. Tel. (603) 924-9455. The* Portable 100 *BBS has just added a ham radio section. Phone (603) 924-9455, stats 300/1200, 8n1. Anyone's welcome anytime.*

. . . Nuge WB8GLQ

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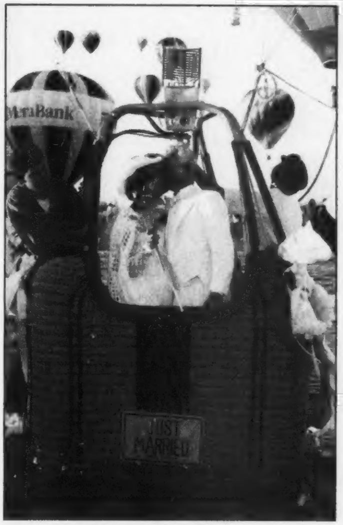

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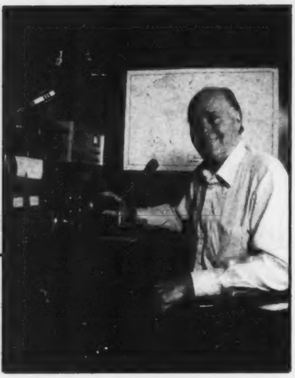

Solving The DXCC Mess

The DXCC award has turned out to be one of the more pernicious and destructive forces in amateur radio. It doesn't have to be. We *can* have our cake and eat it too, to coin a cliché.

If you've isolated yourself on the two meter amateur radio backwater for years, being too busy to spend a few minutes a day for a couple weeks learning the code at 13 per, you've resigned yourself to second class ham citizenship as a Tech, and thus may know little of the awful mess the ARRL's prestigious DXCC award has made of our hobby.

One of the four supposed legal reasons for amateur radio's existence is our ability to generate international good will. The concept is wonderful. Amateur radio provides a means for people-to-people communications around the world. Alas, DXCC has turned our DX bands into aggravating messes...with pileups, lists, tail-ending, etc., making life almost impossible for any ham in even a moderately rare country.

Having operated from several fairly rare spots, and having talked personally with amateurs in many more, I know firsthand what I'm writing. Yes, I had fun working thousands of DXers when I was visiting rare countries...operating contest-style and knocking off several QSOs a minute. It's an exciting experience and one I recommend for any red-blooded ham.

How rare? My first taste was in 1958 when I went to Navassa Island (KC4AF). Wowie, was that fun! In 1959 I operated from Aden, Pakistan, Ceylon, Vietnam, Wake Island and other rare countries. Since then I've been on from Syria, Lebanon, Jordan, Iran, Afghanistan, Kenya, Swaziland, Lesotho, Nepal, Singapore, Sarawak, Sabah, New Caledonia, Fiji, Western Samoa, Tahiti, St. Pierre, and many others.

What I found when I visited rarer countries is that the amateurs living there have been virtually forced off the air by DXers. DXers, driven by the "need" for a QSL, won't permit amateurs in rare countries to enjoy relaxed contacts. They immediately start tail-ending, then breaking in and clobbering the QSO, not to talk with and get to know the amateur, but just to get a signal report and that card. If the DX op tries to ignore these pests, they get more and more abusive and frantic.

The result is that the few hams who manage to get on the air in Third World countries quickly get fed up with this nonsense and take up a new hobby. International friendships? Darned few! This is particularly frustrating for the DX op, who often has invested a tremendous amount of time and money in getting on the air... only to be chased back off by DXCC fanatics.

Contest-style operating can be fun, but not if that's all you ever are allowed to do. It means keeping a detailed log, writing out endless QSL cards and mailing them. The postage involved is horrendous, so most DX hams tend to use QSL managers. This is fun?

If you don't think the chickens come home to roost on this one at the WARC ITU conferences, you've got your head in the sand. We have a powerful vested interest in generating as much support from Third World countries as possible. And guess who gets sent to Geneva for the WARCs? The same chaps we've hounded off the air.

Well, heck, you can't stop hams from collecting countries, right? Even if we didn't have a DXCC, we'd still be looking for the rare ones. Maybe, but the pressure to get on the *QST* Honor Roll is a powerful motivating force. I've known DXers who've built their lives around this farce.

I remember one DXpeditioner who charged Honor Roll hams a hundred dollars for every new country he gave them. He made a business of DXing and did very well at it. The contributions all came by mail in cash, so he paid no taxes on it. He bragged he was making over $150,000 a year this way...and I believe it. I knew him well.

Okay, how can we stop all this nonsense and make it so amateurs who manage to get on the air from a rare spot can actually talk with us? How can we take off the Honor Roll and DXCC pressure? The solution is so simple, it's ridiculous. I should have thought of it years ago.

I was talking with the ARRL's DXCC manager at Hamcom in Dallas, when it struck me! Why not make contacts for DXCC credit only count when made during accredited contests? After all, most contacts with rare countries quickly degenerate into contest-type contacts anyway.

How do we stop some fool contest-oriented magazine from trying to run 52 weekly contests? We might suggest to the League directors that they limit QSL credits to a maximum of six contests a year. We certainly don't want our bands turned into unholy messes every weekend.

This would cut down on QSL costs. DX ops would only have to submit their logs to the ARRL... preferably on a floppy disk...and a computer could do the rest.

By making it so contacts other than during contests would have no award value, we might eventually make it so Third World amateurs will be able to actually get on the air and enjoy interesting contacts.

I've visited these countries and I can tell you that our demand for QSL cards has left a long trail of bitter, angry Third World hams...just what we don't need at world administrative conferences when our ham band allocations come up for grabs.

By concentrating our DXing into a half dozen weekends a year we'd encourage more DXpeditions to be organized. And we might find the hams in the rare countries getting on for some contest operating and enjoying it.

But what about the ten kilowatt overbearing DXer who will kill for a new country? If the DX ops will use my system of making contacts they'll frustrate the hell out of ugly DXers and make it so even QRP and mobile hams will be able to get through. Further, we'll avoid ghastly messes such as the recent Bouvet Island debacle.

Unless you know some DXers you may not realize how much this seemingly insignificant aspect of our hobby can dominate their lives. These are not ordinary hams. They have huge towers, several kilowatts, two-meter spotting nets, and DXing comes first...before work, family, even eating. They have their hundred or so rarest QSL cards in their coat pocket at every ham club meeting, ready to whip out and amaze you.

When a rare one comes on they drop everything until they've made at least two contacts (one for safety). Some true fanatics have to do this on five bands... and every mode. How about a CW contact now, OM? If a new country came on using only slow-scan TV, they'd rush out and buy an SSTV system just to make the contact...and preserve their Honor Roll listing.

You see, if their Honor Roll competitors get a new one and they don't, it's unlikely they'll ever get back where they were on the list. This is why some DXers will spend a thousand dollars to get a new one, if that's what it takes. This is why their QSLs go out with "green stamps" in the envelopes. Heck, I remember when they sent only a dollar, now it's usually a ten or a twenty.

So let's get the ARRL to make a major move toward cleaning up our bands by allowing DXCC credits only for contacts made during specific contests. How do you do that? Write to David Sumner at HQ, to Price, the president, and to your director. Explain it clearly in terms a director can understand ...no change in the DXCC rules,

Continued on page 79

KENWOOD

pacesetter in Amateur Radio

All-mode tri-bander!

Warp Drive!
WORLD RADIO TV HANDBOOK
BASIC GUIDE TO VHF UHF HAM RADIO
SECRETS OF SUCCESSFUL QSLING
THE BUYER'S GUIDE TO AMATEUR
THE PRACTICAL HANDBOOK OF AMATEUR RADIO FM & REPEATERS
AMSAT
PROJECT OSCAR AMSAT
THE SATELLITE EXPERIMENTER'S HANDBOOK
CONTEST VHF-EME UHF-EME LOG
WD200DJY
KENWOOD
KH6WZ

TS-790A

Satellite Transceiver

The new Kenwood TS-790A VHF/UHF all-mode tri-band transceiver is designed for the VHF/UHF and satellite "power user." The new TS-790A is an all-mode 144/450/1200 MHz transceiver with many special enhancements such as automatic uplink/downlink tracking. Other features include dual receive, automatic mode selection, automatic repeater offset selection for FM repeater use, VFO or quick step channel tuning, direct keyboard frequency entry, 59 memory channels (10 channels for separate receive and transmit frequency storage), multiple scanning and multiple scan stop modes. The Automatic Lock Tuning (ALT) on 1200 MHz eliminates frequency drift. Power output is 45 watts on 144 MHz, 40 watts on 450 MHz, and 10 watts on 1200 MHz. (The 1200 MHz section is an optional module.)

- **High stability VFO.** The dual digital VFOs feature rock-stable TCXO (temperature compensated crystal oscillator) circuitry, with frequency stability of ±3 ppm.
- **Operates on 13.8 VDC.** Perfect for mountain-top DXpeditions!
- **The mode switches confirm USB, LSB, CW, or FM selection with Morse Code.**
- **Dual Watch allows reception of two bands at the same time.**
- **Automatic mode and automatic repeater offset selection.**
- **Direct keyboard frequency entry.**
- **59 multi-function memory channels.** Store frequency, mode, tone information, offset, and quick step function. Ten memory channels for "odd split."
- **CTCSS encoder built-in.** Optional TSU-5 enables sub-tone decode.
- **Memory scroll function.** This feature allows you to check memory contents without changing the VFO frequency.
- **Multiple scanning functions.** Memory channel lock-out is also provided.
- **ALT—Automatic Lock Tuning—on 1200 MHz eliminates drift!**
- **500 Hz CW filter built-in.**
- **Packet radio connector.**
- **Interference reduction controls:** 10 dB RF attenuator on 2m, noise blanker, IF shift, selectable AGC, all mode squelch.
- **Other useful controls:** RF power output control, speech processor, dual muting, frequency lock switch, RIT.
- **Voice synthesizer option.**
- **Computer control option.**

Optional Accessories:
• **PS-31** Power supply • **SP-31** External speaker • **UT-10** 1200 MHz module • **VS-2** Voice synthesizer unit • **TSU-5** Programmable CTCSS decoder • **IF-232C** Computer interface • **MC-60A/MC-80/MC-85** Desk mics • **HS-5/HS-6** Headphones • **MC-43S** Hand mic • **PG-2S** Extra DC cable

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features, and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
Long Beach, CA 90801-5745
KENWOOD ELECTRONICS CANADA INC.
P.O. BOX 1075, 959 Gana Court
Mississauga, Ontario, Canada L4T 4C2

KENWOOD

The DXpeditioner!

TS-440S

Compact high performance HF transceiver with general coverage receiver

Portable reliable performance and ease of use makes the TS-440S your obvious "low bands" choice. It is "Every Ham's" rig to go — ham shack, portable or mobile. But don't let the small size fool you — there's lots of "big rig" performance packed into this package. Built-in antenna tuner option. Continuous duty transmitter. Super DynaMix™ front end. Five filter functions. The TS-440S is at your service wherever you wish to operate.

- **Covers all Amateur bands**
  General coverage receiver tunes from 100 kHz–30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **VS-1 voice synthesizer (optional)**
- **Built-in automatic antenna tuner (optional).** Covers 80–10 meters.
- **5 IF filter functions**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m.)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB. 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)
- **Computer interface port**
- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**

SQL
NOTCH
AF
RF
SELECTIVITY
MIC
CAR
RIT/XIT
IF SHIFT
AGC
NOTCH
PROC
F.LOCK
FUNCTION
RIT
XIT
A-B
SPLIT
T-F SET
A=B
1MHz
BAND
14.200.0
HF TRANSCEIVER
MODE/KEY
LSB
USB
CW
AM
FM
FSK
CLEAR
ENT
M.IN
POWER

- **MC-43S UP/DOWN mic. included**
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and opt. filters fight QRM.
  - **Dual SSB IF filtering**
    A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**

Optional accessories:

- **AT-440** internal auto. antenna tuner (80 m – 10 m) • **AT-250** external auto. tuner (160 m – 10 m) • **AT-130** compact mobile antenna tuner (160 m – 10 m) • **IF-232C/IC-10** level translator and modem IC kit • **PS-50** heavy duty power supply • **PS-430** DC power supply • **SP-430** external speaker
- **MB-430** mobile mounting bracket
- **YK-88C/88CN** 500 HZ/270 Hz CW filters
- **YK-88S-88SN** 2.4 kHz/1.8 kHz SSB filters • **MC-60A/80/85** desk microphones • **MC-55** (8P) mobile microphone
- **HS-4/5/6/7** headphones • **SP-41/50B** mobile speakers • **MA-5/VP-1 HF** 5 band mobile helical antenna and bumper mount
- **TL-922A** 2 kw PEP linear amplifier
- **SM-220** station monitor (no pan display)
- **VS-1** voice synthesizer • **TU-8** CTCSS tone unit • **PG-2C** extra DC cable.

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Mississauga, Ontario, Canada L4T 4C2

KENWOOD

... pacesetter in Amateur Radio

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Emergency Connections and Kit

The ability to easily interchange equipment between stations may be crucial in an emergency. All stations active in the Amateur Radio Emergency Service (ARES) should use a common type of power connector throughout their stations, or they should keep an adapter on hand. Dick Rawson N6CMJ, writing in the June issue of *Electronics Museum* ARC newsletter, suggests Molex™ 2-pin (0.093-diameter pins), 12-amp connectors with a contact resistance of 0.0025 ohms, 2.5 mV/A. However, this connector is not suitable for long-term outside use because it is not weatherproof.

Make sure that polarization is the same from station to station. The POSITIVE pin is on the FLAT side of the connector, and the NEGATIVE is on the POINTED side. *[Ed. Note: Standardization is important between stations because some hams use an opposite polarity arrangement, myself included].* The source side of the connector (from the power supply) is the MALE housing, with the FEMALE pins to be installed. The radio side is the FEMALE housing, with the MALE pins to be installed.

Waldom Part No. 1545PRT, a package of three sets, contains Molex parts 03-09-2021 (plug), 03-09-1021 (receptacle), 03-09-1118 (female pins), and 03-09-2118 (male pins). Radio Shack's one-connector set is #274-0222.

In the May issue of the above newsletter, the editors state that rubber duck antennas and NiCd battery packs are severe handicaps during a prolongued communications emergency. NiCd batteries last only a few hours, so your emergency communications kit should include some alkaline batteries. As for antennas, you can quickly attach a J-pole 2m antenna to a school flagpole and hoist it up 30 feet, or throw it up over a tree branch with some nylon rope and a rock *[look carefully before you throw].* A small generator or a deep cycle 12-volt battery can keep your 2m and HF radios operating when the power is out.

In addition to the right connections mentioned previously, your kit should contain: adapters, extra coax with fitting, AC power supply, large alligator clips on a power cord for using a car battery, and a high capacity (800 mAh) NiCd pack for your HT. A magnetic mount antenna and power cord with cigarette lighter adapter and a pair of earphones can come in handy, too.

KB5AWM and KB2IGG Receive Awards

On June 9, 1990, James "Jim" Heil KB5AWM received the 1990 Amateur Ambassador Award at the ARRL National Convention in Kansas City, Missouri. Mike Lamb N7ML, president of Advanced Electronic Applications, Inc., presented the award.

AEA presents the award yearly to the radio amateur who demonstrates extraordinary efforts in promoting the amateur service to individuals new to amateur radio. Jim Heil was chosen because he has organized and taught numerous Novice classes, elmers new hams, and has served as a VE and VE coordinator.

As ARRL Public Information Officer, Jim has managed to get an amateur radio announcement on the local cable system and write articles about ham club activities and amateur radio for the local newspapers. With the Clear Lake Amateur Radio Club (CLARC), Jim helped donate books on amateur radio to the local library.

Since becoming licensed in 1986 at the age of 18 (and upgrading to Extra Class the following year), Jim helped establish CLARC, which has grown from seven to over 130 members, and he edits the club's newsletter, the *CLARC Chronicles.* For two years, he was vice-president of CLARC. He is a member of Skywarn, RACES, and ARES, and assists in public events that can benefit from amateur radio. Jim, a full-time student at the University of Houston at Clear Lake, is pursuing a degree in computer information systems.

Former recipients of the AEA Amateur Ambassador Award include Mary Duffield WA6KFA, Barry Goldwater K7UGA, Byron Lindsey W4BIW, and Bob Wallar WB6QNR. AEA will accept entries for the 1991 award through May 1, 1991. All entries must include an outline of the nominee's activities in three categories: dedication to amateur radio, positive influence on those outside of the Amateur Radio Service, and initiation of special projects or programs to promote amateur radio. The recipient of the award receives $1,000 and an expense-paid trip to the ARRL National Convention. Send entries to AEA, Attn: Amateur Ambassador Award, P.O. Box 2160, Lynnwood WA 98036.

Twelve-year-old Mary F. Alestra KB2IGG, featured in "Ham Profiles" in the February 1990 issue, was named the 1990 *Westlink Report* Young Ham of the Year. The award, a plaque detailing her accomplishments, was presented to Mary by Burt Hicks WB6MQV, *Westlink* publisher, and Bill Pasternak WA6ITF, contributing editor of same, at a banquet also on June 9 at the ARRL Convention. As part of the award, Mary received an all-expense paid trip to the Convention and new radio equipment from Yaesu, a complete set of amateur radio training materials from Gordon West WB6NOA, and a three-year subscription to *73 Magazine* compliments of Wayne Green W2NSD.

Mary, a student of Rocco Laurie Intermediate School in New York City, was chosen to receive this award because of her many accomplishments in amateur radio in the short time since first exposed to it by Carole Perry WB2MGP (see Mary's interview with Carole in the May issue). Interested in other cultures, Mary has discovered the joys of contacting people all over the world, as well as locally. Using borrowed radio equipment, on bus trips she has kept hundreds of students, some of them out of state, in contact with the school principal and hams who could help in case of mechanical problems or emergencies.

One of Mary's favorite ham activities is participating in the "CQ All Schools Net," a hookup of dozens of schools around the country. Mary has developed a high level of competence in handling traffic, and her skill at operating various types of radio gear often astounds the more experienced devotees of the hobby. Her irrepressible enthusiasm is quickly communicated to her classmates, and she enjoys helping them get started in amateur radio.

Mary says that amateur radio has helped her greatly in her school work, especially in geography and social studies, and that she is becoming increasingly interested in the scientific and experimental aspects of ham radio.

For nominating Alestra, Carole will be given a complete set of all currently available amateur radio promotional and educational videotapes produced by Roy Neal K6DUE, Frosty Oden N6ENV, and Bill Pasternak WA6ITF from *Amateur Radio Newsline.*

Past winners include Erin McGinnis KA0WTE (1989), Jonathan Binstock NK3D (1988), David Rosenman KA9PMK (1987), and Shawn Alan Wakefield WK5P (1986). TNX *Westlink Report* and *AEA.*

Get Ready for More RFI

OTH-B, the Over the Horizon Backscatter radar system with transmitters in Moscow, Maine, and receivers in Columbia Falls, Maine, is only the first of four such systems to be built. A system spanning California, Idaho, and Oregon is now 90% complete. The central system will be based in North and South Dakota, and Minnesota. The fourth system will be in Alaska. OTH-B has a range 10 times greater than that of conventional radar, and will be useful in detecting small drug-smuggling planes as well as serving as an early warning system.

OTH-B is also known as the "woodpecker" because the interference it causes in shortwave communications resembles the rhythmic pecking of this bird. According to GE, the builder, the transmissions will include the following frequencies: 5 MHz (what about WWV?), 6.74–9.09 MHz (40m?), 9.09–12.24 MHz (30m?), and during the day, 12.25 to 16.50 MHz (20m), 16.50 to 22.25 MHz (18m and 15m), and 22.25 to 28 MHz (possibly affecting the 24 and 10m bands). And now Japan and Australia are also interested in setting up their own OTH-B radar systems!

However, Kokusai Denshin Denwa Co., Ltd. in Japan has developed equipment which almost completely eliminates "woodpecker" interference without using noise-blanking methods. At present, this new equipment is only used on ship telephones, but amateur radio use is under consideration. TNX *Crosstalk,* newsletter of the TRW ARC, *The JARL News,* and *Amateur Radio Newsline.*

TNX again . . .

To all our contributors. You can reach us by phone at (603) 525-4201 or by mail *73 Magazine,* Forest Rd., Hancock NH 03449; on CompuServe ppn 70310,775; MCI Mail "WGEPUB"; GEnie, "MAG73"; and the *73* BBS at (603) 525-4438 (300–2400 bps), 8 data bits, no parity, one stop bit.

AEA ...Brings You A Better Experience

Keyers

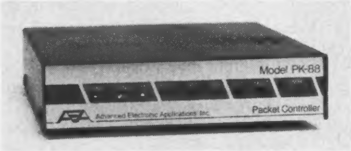
The Morse Machine MM-3 Keyer

The Morse Machine has all the features you need in a memory keyer, including 2 to 99 WPM speed selection and over 8,000 characters of soft-partitioned memory. Twenty memories store your messages...as short or as long as you like. Memory can be expanded to 36,000 characters. All memory is backed up by an internal lithium battery.

Comprehensive Morse training facilities are built-in. **A Proficiency Trainer** for random code group practice. **A Random Word Generator** which generates four-letter words and **A QSO Simulator** which allows you to call stations, answer a CQ or listen to realistic on-the-air QSO's.

The MM-3 also features automatic serial number insertion and incrementing in any memory message. Use the front panel knob to adjust your sending speed or enter a precise speed with the keypad, toggling between the two at any time. Exchanges can be expedited by having parts of your message sent at a higher speed. You can even add remote switches for four of the memories to send your response or call CQ. The MM-3 can also be programmed for automatic beacon use. The RS-232 compatible serial I/O port provides computer control of the MM-3 and monitoring of the Morse training features.

Packet



PK-88 Packet Radio TNC

Unique operating features with a proven hardware and software design make AEA's PK-88 your best choice in packet radio--now with MailDrop, an 8KByte efficient personal Mailbox. The PK-88 also allows multiple single frequency QSO's, digipeating and networking. It's a superb value, packed with all the most needed packet radio features such as direct interface capability with NET/ROM and TCP/IP. In addition to all the features of a "standard" TNC, the PK-88 offers features not found in any other TNC:

- WHYNOT command - Shows reasons why some received packets are not displayed.
- "Packet Dump Suppression" - Prevents dumping unsent packets on the radio channel when the link fails.
- CUSTOM Command - Allows limited PK-88 customization for non-standard applications.
- Enhanced MBX command- Permits display of the data in I- and UI-frames, without packet headers and without packet headers or retried frames.
- Enhanced MPROTO command - Suppresses display of non- ASCII packets from Level Three switches and network nodes.

Multi-Mode

PK-232MBX Multi-Mode Data Controller

With over 40,000 units sold worldwide, the PK-232MBX is the world's leading multi-mode data controller. Combining all amateur data communication modes in one comprehensive unit, the PK-232MBX offers Morse Code, Baudot, ASCII, AMTOR/SITOR 476 and 625, HF and VHF Packet, WEFAX receive and transmit, TDM, as well as commercial standard NAVTEX automated marine information services.

All software is on ROM.

- 20 front panel status and mode LED indicators
- RS-232 compatible
- Exclusive SIAM™ Signal Identification and Acquisition Mode
- TDM Time Division Multiplex decoding
- PakMail™ mailbox with selective control of third-party traffic
- FAX printing - supports most printers
- Two radio ports
- Host mode for efficient program control of the PK-232MBX
- KISS mode for TCP/IP networking protocol compatibility
- 32K RAM lithium battery-backed
- Many features for the digital SWL

Antenna Tuners

AT-300 and AT-3000 Antenna Tuners

For tuning perfection, choose AEA's AT-300 (300 watt) or AT-3000 (3 kW) antenna tuners. Quality and exceptional engineering are built-in for maximum performance and long operating life.

The low-pass design provides more harmonic attenuation for lower TVI and allows matching to a much wider range of antenna impedances than common high-pass designs.

The AEA tuners feature a frequency compensated dual-movement SWR meter for ease of tuning with a front panel power range switch. Minimal SWR is achieved by inductors with 18 (AT-300) and 20 (AT-3000) taps. AEA's exclusive patent pending CAM switch design on the AT-3000 provides accurate tuning. The built-in front panel antenna switch allows you to easily select two unbalanced (coax-fed) antennas, a dummy load or a balanced antenna.

Advanced Electronic Applications, Inc. 2006-196th St. SW/P.O. Box 2160 Lynnwood, WA 98036 206-775-7373
Specifications subject to change without notice or obligation. Dealer inquiries invited. Copyright 1990.

BEST OF MFJ

MFJ, Bencher and Curtis team up to bring you America's most popular keyer in a compact package for smooth easy CW

VOLUME
SPEED
AUTO
SEMI AUTO
OFF
MFJ ELECTRONIC KEYER PADDLE
MFJ PACESETTER
MFJ ELECTRONIC KEYER PADDLE

MFJ-422B

$134.95

The best of all CW world's -- a deluxe MFJ Keyer using a Curtis 8044ABM chip in a compact package that fits right on the Bencher iambic paddle!

This MFJ Keyer is small in size but big in features. you get iambic keying, adjustable weight and tone and front panel volume and speed controls (8-50 WPM), dot-dash memories, speaker, sidetone and push button selection of automatic or semi-automatic/ tune modes. It's also totally RF proof and has ultra-reliable solid state outputs that key both tube and solid state rigs. Use 9 volt battery or 110 VAC with MFJ-1305, $12.95.

The keyer mounts on a Bencher paddle to form a small (4-1/8 x 2-5/8 x 5½ inches) attractive combination that is a pleasure to look at and use.

The Bencher paddle has adjustable gold plated silver contacts, lucite paddles, chrome plated brass and a heavy steel base with non-skid feet.

You can buy just the keyer assembly, MFJ-422BX, for only $79.95 to mount on **your** Bencher paddle.

Deluxe 300 W Tuner

MFJ-949D
$149.95

MFJ-949D is the world's most popular 300 watt PEP tuner. It covers 1.8-30 MHz, gives you a new peak and average reading Cross-Needle SWR/Wattmeter, built-in dummy load, 6 position antenna switch and 4:1 balun -- in a compact 10 x 3 x 7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

Antenna Bridge

MFJ-204B
$79.95

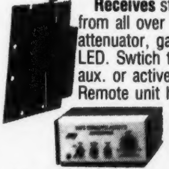
Now you can quickly optimize your antenna for peak performance with this portable, totally self-contained antenna bridge.

No other equipment needed -- take it to your antenna site. Determine if your antenna is too long or too short, measure its resonate frequency and antenna resistance to 500 ohms. It's the easiest, most convenient way to determine antenna performance. Built in resistance bridge, null meter, tunable oscillator-driver (1.8-30 MHz). Use 9 V battery or 110 VAC with AC adapter, $12.95.

Super Active Antenna

"World Radio TV Handbook" says MFJ-1024 is a "first rate easy-to-operate active antenna ... quiet ... excellent dynamic range ... good gain ... very low noise ... broad frequency coverage ... excellent choice."

Mount it outdoors away from electrical noise for maximum signal, minimum noise. Covers 50 KHz to 30 MHz.

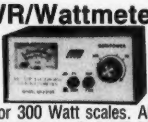


Receives strong, clear signals from all over the world. 20 dB attenuator, gain control, ON LED. Swtich two receivers and aux. or active antenna. 6x3x5 in. Remote unit has 54 inch whip, 50 ft. coax and connector. 3x2x4 in. Use 12 VDC or 110 VAC with MFJ-1312, $12.95.

MFJ-1024 **$129.95**

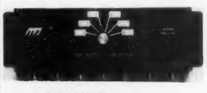
VHF SWR/Wattmeter

MFJ-812B
$29.95



Covers 2 Meters and 220 MHz. 30 or 300 Watt scales. Also reads relative field strength 1-170 MHz and SWR above 14 MHz. 4½x2¼x3 in.

MFJ Coax Antenna Switches



$34.95 MFJ-1701

$21.95 MFJ-1702B

$59.95 MFJ-1704

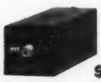
Select any of several antennas from your operating desk with these MFJ Coax Switches. They feature mounting holes and automatic grounding of unused terminals. They come with MFJ's one year **unconditional** guarantee.

MFJ-1701, $34.95. Six position antenna switch. SO-239 connectors. 50-75 ohm loads. 2 KW PEP, 1 KW CW. Black alum. cabinet. 10x3x1½ inches.

MFJ-1702B, $21.95. 2 positions plus new Center Ground. 2.5 KW PEP, 1 KW CW. Insertion loss below .2 dB. 50 dB isolation at 450 MHz. 50 ohm. 3x2x2 in.

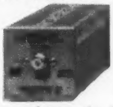
MFJ-1704, $59.95. 4 position cavity switch with lightening/surge protection device. Center ground. 2.5 KW PEP, 1 KW CW. Low SWR. Isolation better than 50 dB at 500 MHz. Negligible loss. 50 ohm. 6¼x4¼x1¼ in.

"Dry" Dummy Loads for HF/VHF/UHF



MFJ-260B
$28.95

MFJ-262
$69.95



MFJ-264
$109.95

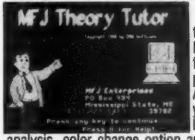
MFJ has a full line of dummy loads to suit your needs. Use a dummy load for tuning to reduce needless (and illegal) QRM and save your finals.

MFJ-260B, $28.95. VHF/HF. Air cooled, non-inductive 50 ohm resistor. SO-239 connector. Handles 300 Watts. Run full load for 30 seconds, derating curve to 5 minutes. SWR less than 1.3:1 to 30 MHz, 1.5:1 to 150 MHz. 2½x2½x7 in.

MFJ-262, $69.95. HF.1 KW. SWR less than 1.5:1 to 30 MHz. 3x3x13 in.

MFJ-264, $109.95. Versatile UHF/VHF/HF 1.5 KW load. Low SWR to 650 MHz, usable to 750 MHz. Run 100 watts for 10 minutes, 1500 watts for 10 seconds. SWR is 1.1:1 to 30 MHz, below 1.3:1 to 650 MHz. 3x3x7 inches.

MFJ Ham License Upgrade Theory Tutor



MFJ Theory Tutor practically guarantees you'll pass the theory part of any FCC ham license exam. Versatile MFJ software is the best computer tutor ever tailor-made for ham radio. You can study the entire FCC question pool, selected areas and take (or print) sample tests. Auto. saves each study session (ex. sample tests), gives you all FCC test graphics (ex. mono.), explanations of hard questions, pop-up calculator, weighted scoring analysis, color change option and more. **Order** MFJ-1610-**Novice**; MFJ-1611-**Tech.**; MFJ-1612-**Gen.**; MFJ-1613-**Adv.**; MFJ-1614-**Ex.** for **IBM compatible.** For **Macintosh:** MFJ-1630-N; MFJ-1631-T; MFJ-1632-G; MFJ-1633-A; MFJ-1634-E, **$29.95** per license class.

MFJ Speaker Mics

MFJ-284 or MFJ-286
$24.95

MFJ's compact Speaker/Mics let you carry your HT on your belt and never have to remove it to monitor calls or talk.

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Huge 5/8 inch bold LCD digits let you see the time from anywhere in your shack. Choose from the dual clock that has separate UTC/local time display or the single 24 hour ham clock.

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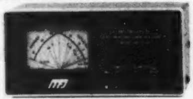
MFJ-815B
$69.95



MFJ Cross-Needle SWR/ Wattmeter has a new **peak** reading function! It shows you SWR, forward and reflected power in 2000/500 and 200/50 watt ranges. Covers 1.8-30 MHz.

Mechanical zero adjusts for movement. SO-239 connectors. Lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

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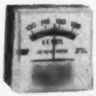

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CIRCLE 86 ON READER SERVICE CARD

Number 4 on your Feedback card

Omni-Gain Vertical Collinear for VHF and UHF

Coax comes alive II, the next generation.

by Mike Collis WA6SVT

This rugged antenna, an omnidirectional collinear, is capable of surviving harsh environments. It's a good choice for repeater installations and it can be easily top- or side-mounted to the tower. You can obtain approximately 3–10 dB gain over a dipole, depending on the number of elements you use. The higher the gain, the narrower the elevation pattern. Bandwidth is normally 10 MHz on the 70cm band and 25 MHz on 23cm, making the antenna an excellent candidate for ATV repeater use. Many improvements have been made since my original article, "Omni-Gain: Collinear for 70 Cm and 23 Cm," was first published in the May 1982 issue of *73*.

The main elements are constructed from ½-wavelength sections of coaxial cable. You can calculate the element length using the formula of 5904 divided by the frequency (MHz) times the velocity factor of the coaxial cable. In my original article, I used RG-213 with a velocity factor of 0.66. I now use RG-11 or CAC-11 (a solid conductor aluminum shield cable) for high power antennas and RG-6 for low power.

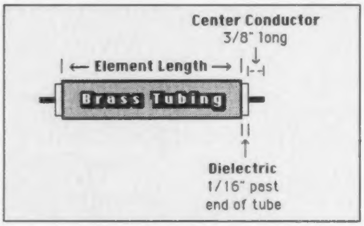
Center Conductor
3/8" long
← Element Length →
Brass Tubing
Dielectric
1/16" past
end of tube

Figure 1. Element preparation.

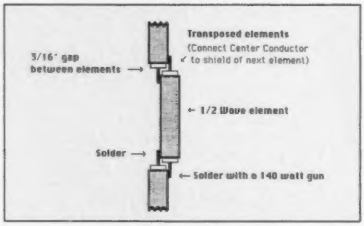
Transposed elements
(Connect Center Conductor to shield of next element)
3/16" gap between elements →
← 1/2 Wave element
Solder →
← Solder with a 140 watt gun

Figure 2. Element assembly.

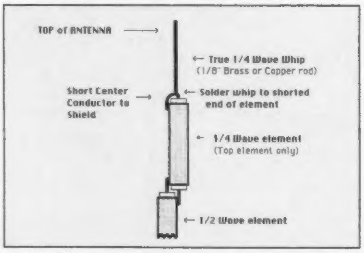
TOP of ANTENNA →
← True 1/4 Wave Whip
(1/8" Brass or Copper rod)
Short Center Conductor to Shield →
← Solder whip to shorted end of element
← 1/4 Wave element
(Top element only)
← 1/2 Wave element

Figure 3. Top section of collinear.

To begin construction, remove the jacket and shield from each element and slide it into hobby brass tubing. Select the diameter of the brass tube to just fit snugly over the dielectric of the coax. The brass tube provides a more rigid support for each element and makes it easier to solder them together. Use the above formula to calculate the lengths of the brass tubes. Cut the coax segment long enough to allow 1/16" of the dielectric and ⅜" of the center conductor to extend past each end of the tube. Make as many ½-wave elements as needed for the gain you desire: 4 elements = approx. 3.5 dBd; 8 elements = 6 dBd; 18 elements = 9 dBd; and 21 elements = 10 dBd. In addition, you need a ¼-wave element and a ¼-wave whip for the top of the antenna. The whip is cut to a true one-quarter wavelength (no velocity factor correction) and is made out of number 12 wire or ⅛" brass rod. *[Editor's note: If brass tubing is unavailable, you can leave the shield and jacket of each element intact. Cut the shield to the formula length and remove enough of the jacket to allow soldering.]*

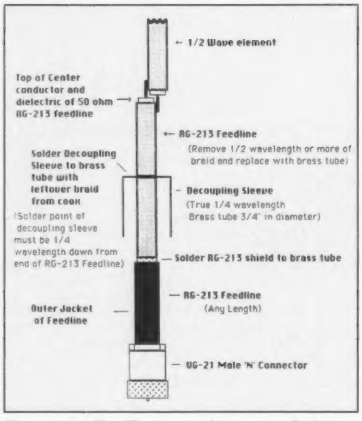
← 1/2 Wave element
Top of Center conductor and dielectric of 50 ohm RG-213 feedline →
← RG-213 Feedline
(Remove 1/2 wavelength or more of braid and replace with brass tube)
Solder Decoupling Sleeve to brass tube with leftover braid from coax
(Solder point of decoupling sleeve must be 1/4 wavelength down from end of RG-213 Feedline)
– Decoupling Sleeve
(True 1/4 wavelength Brass tube 3/4" in diameter)
– Solder RG-213 shield to brass tube
– RG-213 Feedline
(Any Length)
Outer Jacket of Feedline
– UG-21 Male 'N' Connector

Figure 4. Feedline attachment and decoupling sleeve.

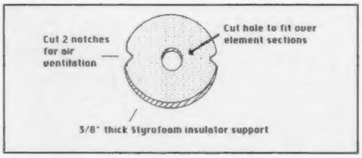
Cut 2 notches for air ventilation
Cut hole to fit over element sections
3/8" thick Styrofoam insulator support

Figure 5. Styrofoam spacer (3 or more needed).

Constructing the Collinear

Step 1. Determine the length of the ½-wave elements (brass tube or coax shield) using the following formula: 5904/F (MHz) x Velocity Factor. Use the manufacturer's velocity factor for the cable you plan to use. Solid polyethylene usually has a velocity factor of 0.66 while foam cable ranges from 0.79 to 0.83.

Step 2. If you desire a downtilt, cut the elements 2% shorter than calculated in Step 1. See Figure 6a for elevation patterns.

Step 3. Cut lengths of RG-11 (or RG-6) coax approximately ¾" longer than the element tubing.

Step 4. Remove the outer jacket and shield and slide the dielectric and center conductor into the brass tube.

Step 5. Using a knife, cut the dielectric so that it sticks out 1/16" past each end of the brass tube. This should leave approximately ⅜" of the center conductor exposed on each end. See Figure 1.

Step 6. Solder the center conductor of each element to the outer conductor of the next element, making sure to keep the whole antenna as straight as possible. With a small wire wrapped around the tube, you can hold the center conductor in place next to the brass tube. After soldering, remove the ends of this wire with cutters. See Figure 2.

Step 7. The last element is ¼-wave long, exactly half the measured length of the ½-wave element. Short out the top end of this section by bending over the center conductor and soldering it to the brass tube. The ¼-wave whip is attached at this point. The whip is a true ¼-wave (no velocity factor correction) and can be contructed out of any diameter brass rod. See Figure 3.

Step 8. The 50 ohm feedline can be any length. I used RG-213 or 214 coax with an N connector attached. Strip off at least a half wavelength of the shield on the other end of the feedline. Leave about an inch of the shield sticking out of the vinyl jacket. Cut back the dielectric to expose ⅜" of the center conductor. Slide a half-wave or longer brass tube

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- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
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- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- Many **built-in diagnostic** & testing functions using microprocessor.
- Color coded led's **indicate status** of all major functions.
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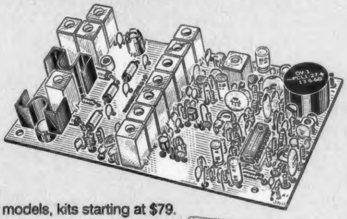

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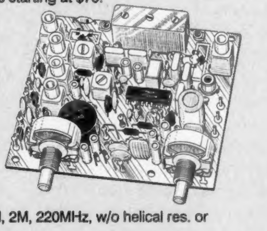

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- **R451 UHF FM RCVR,** similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
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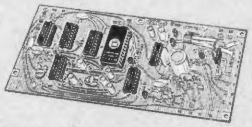
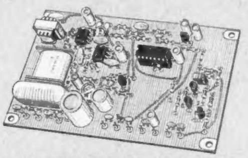
CWID kit. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3 .... $59



NEW **COR-4** kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call .. $99

NEW **TD-3 SUBAUDIBLE TONE DECODER/ENCODER** kit. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions $24

TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79



AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std . $79

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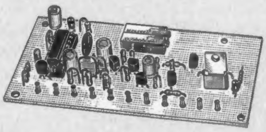

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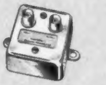

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- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

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LNS-(*)

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902-928 MHz converts down to 422-448 or 430-450 range. Same price as uhf.

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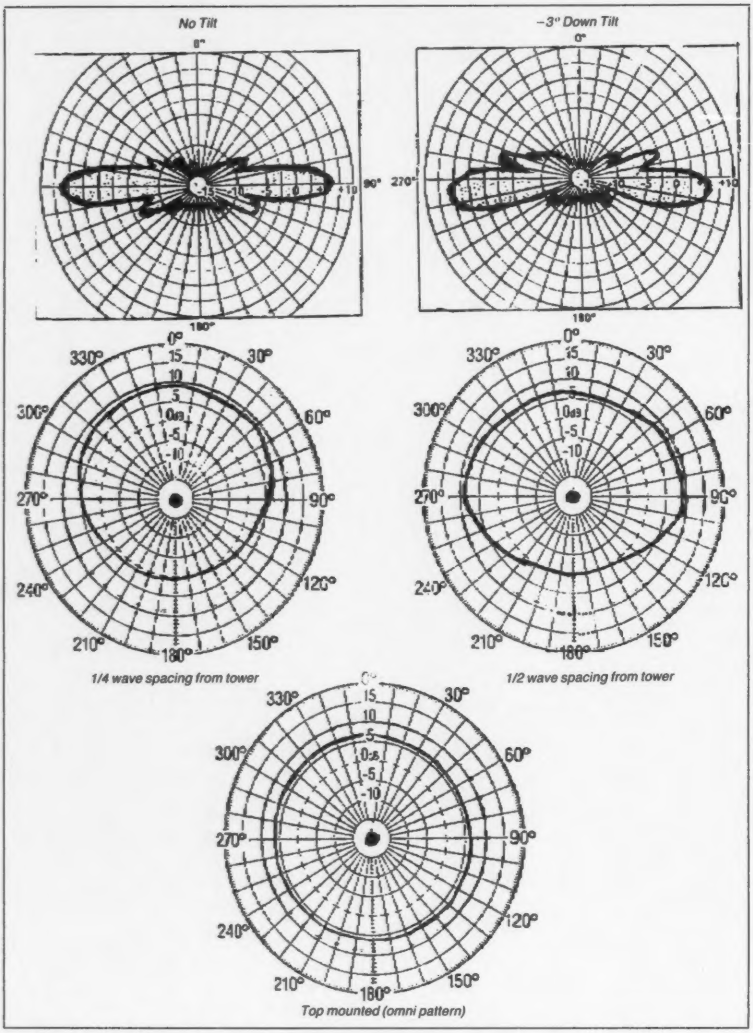
CIRCLE 57 ON READER SERVICE CARD


No Tilt

−3° Down Tilt

1/4 wave spacing from tower

1/2 wave spacing from tower

Top mounted (omni pattern)

Figure 6. a) Elevation patterns for 6 dB antenna; b) Azimuth patterns for 6 dB antenna.

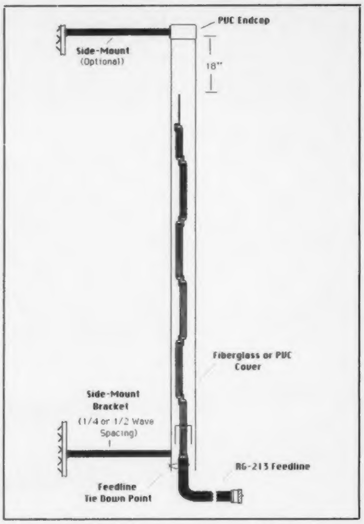


Figure 7. Completed collinear (four ½-wave elements).

over the end of the feedline so that the 1″ length of braid can be placed over the bottom of the tube. Solder the feedline braid to the bottom of the brass tube.

Step 9. Next, make a true ¼-wave (no velocity factor correction) long decoupling sleeve out of a ¾″ diameter brass tube. Using some of the excess shield material, solder the decoupling sleeve to the feedline outer conductor at a point exactly ¼-wavelength down from the point where the feedline attaches to the antenna. See Figure 4.

Step 10. Attach the exposed end of the feedline to the bottom of the collinear (center conductor of feedline to outer conductor of the antenna).

Step 11. Make at least 3 styrofoam spacers to slip over some of the antenna elements. Cut the spacers for a diameter slightly less than the inside diameter of the radome pipe. Space them out to evenly support the antenna when you place it in the fiberglass (or PVC) radome cover. The spacers should be attached to the midpoint of the element with a small amount of epoxy. See Figure 5.

Step 12. Cut a piece of fiberglass pipe (or PVC) so that 18 inches or more extend past the top of the whip and below the decoupling sleeve. Slide the antenna carefully into the fiberglass pipe and cap off the top of the pole. Drill two holes near the bottom of the radome pipe and pass an insulated wire through and around the feedline (below the decoupling sleeve). Twist the wire until it holds the feedline tightly against the radome cover. Place another styrofoam spacer on the very end of the pipe and glue it in place. Make sure to poke a few small holes or notches in the spacer to allow the end of the antenna to breathe. You're now ready to fire up your collinear! See Figure 7. *[Ed. Note: You can obtain economical fiberglass tubes custom made to your dimensions from: Lightning Bolt Antennas, RD #2, Route 19, Volant PA 16156. Telephone 1-412-530-7396].*

Tune Up and Operation

Find a clear area, free of obstructions, in your back yard. Mount the antenna to a pole, making sure to clamp the antenna to the mast at a point below the decoupling sleeve area. Attach a wattmeter or VSWR meter at the antenna. If the SWR is over 1.5:1 you can adjust the decoupling sleeve slightly up or down the feedline for the best reading.

If you've designed the antenna for a downtilt, you can check it by observing the signal strength of a nearby repeater. Tilt the antenna until the signal peaks, then measure the angle of tilt with a protractor. If it checks out, you're ready to mount to your tower!

Mounting the collinear on top of your tower will give you an omni-directional pattern. If you desire a cardioid pattern, or if your only option is side-mounting, you can mount the antenna to the side of the tower with one or two brackets. Make sure the bottom support is attached to the antenna below the decoupling sleeve, and that the top support is mounted 18″ or more above the top of the whip. Mounting the collinear ¼-wavelength away from the side of the tower will give you about a 2 dB increase in the frontal lobe of the pattern. A spacing of ½-wavelength will increase the signal 2 dB at 90 degree angles to the frontal lobe. Both patterns give a null in the direction of the tower. See Figure 6b.

This antenna should handle the worst Mother Nature can throw at it. It has performed admirably at the ATV repeater site on 5670-foot Santiago Peak for many seasons. Mounted on the tower, it blends right in with the commercial antenna installations. Apparently it was convincing enough to attract antenna marauders, as it was recently stolen! Guess it's time to design the Mark III version complete with a burlar alarm . . .

Mike Collis WA6SVT is active on amateur television (ATV) in the Los Angeles area and works as a communications supervisor for San Bernadino County. You may reach him at P.O. Box 1594, Crestline CA 92325.

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CIRCLE 60 ON READER SERVICE CARD

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DR-590T

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FEATURES

- **Simultaneous**
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- **Independent VHF & UHF Controls**
- **Detachable**
  With the optional remoting kit, the front panel can be seperated from the main unit.
- **DSQ (DTMF Squelch) Function**
- **Code Squelch Function**
  You can program a 3 digit code that will open the squelch only when the same code signal is receive from another transceiver. This allows for selective receiving. Additionally, with the optional tone squelch unit, the code squelch and tone squelch work together as a powerful calling function.
- **Various Useful Paging Functions for Grouping Calling and Individual Calling**
- **Remote Control Microphone**
  With this microphone there are several functions that can be controlled remotely:
  1. Direct setting of frequencies in VFO mode
  2. Up/Down of memory channels in memory mode
  3. Shifting to call mode
  4. ARM (Automatic Repeater Mode)
  5. VHF/UHF Switching
  6. Up/Down by 1 Mhz steps
  7. Setting and Selecting DSQ codes
  8. Setting and Automatic Dialer
- **Scanning Features**
  Memory Scan, Program Scan, ARM Scan, Band Scan, and more Scan.
- **Memory Channels**
  The unit has 28 memory channels, one independent "Call" channel, and 10 ARM memory channels (40 channels in total). You can program set tones, shift frequences, shift directions, and channel steps in each of the 28 memory channels.
- **ARM (Automatic Repeater Memory) Function**
  10 repeater channels can be memorized automatically. While ARM mode is active, scanning stops at vacant channels and pauses, then starts again automatically. This function is useful to find vacant repeaters.
- **ABX (Automatic Band Exchange) Function**
- **Bell Function**
- **Dimmer Function**
  Selectable 2 different brightness of LCD light
- **Three Priority Functions**
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- **Repeater Operation**
  The DR-590T can be used as a cross band repeater.
- **Full Duplex Cross band Operation**
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High on ATV

A marriage made in heaven!

by Earl Campbell KS8J

On November 12, 1988 several ATV firsts were accomplished during the Thunderbird Hot Air Balloon Race over Phoenix, Arizona.

Actually, I had more on my mind that day than ATV. This was THE day for Tommy N7KBO and me. It started out with my betrothed mentioning that she had never had a ride in a hot air balloon. "Well," I said, "how would it be if we got married in one?" The rest is history; she accepted and we did. After much planning and coordinating with countless members of the ham radio/ATV community and balloonists, our hot air balloon wedding was held at sunrise on that November morning.

What a view! What a ride! What a crowd! It's not every day you have a couple getting married in a hot air balloon over Phoenix with 30,000 people watching. We had ministers fighting over who was to perform the ceremony. This was not only the first balloon ride for the bride, it was also the first hot air wedding for both the minister and the balloon pilot.

Photo A. Tommy N7KBO and Earl KS8J prepare to float on the air.

Photo B. Ready for liftoff.

Photo C. The nervous groom forgets to lower the antenna.

Photo D. The bride gets ready to throw the bouquet.

To add to the event, the ceremony was broadcast over ATV to the witnesses and crowd below. In addition, Norm WV7K and Wayne N7MAO sent back pictures of the ceremony from yet another camera angle from a nearby balloon. This was the first balloon-to-balloon two-way contact while in flight, and the first broadcast of a wedding over ATV. Soon after launch I was to lower the Ringo Ranger strapped to the side of the basket but in all the excitement I neglected this detail. Not that it mattered much as the signal was snow-free anyways all over Phoenix. We had reports that people were tuning their cable TV boxes to our frequency and watching from their houses. The flight lasted over two hours and we came within 300 feet of the target in the "hare and hound" race. That's right—we were in the race, to boot! (We didn't win the race but I won the best prize of the event.)

For my wife, who endures all the crazy doings of the local ATV club, this was just a normal thing our group in Phoenix seems to do. The local AAA5 club (Arizona Amateur A5 club) and all the others who saw the event were glad to see the exposure ATV experienced from this event. My wife and I are very active in the AAA5 club here in Phoenix and wish to thank everybody involved for the most enjoyable day of our lives.

I know many of you *73* readers will say, "What will those young ham radio people think of next?" Well, think again about this "young" couple. We have six children and nine grandchildren. We flew them all to Phoenix to attend the wedding. The rest of the wedding was very traditional! The bride wore a long white gown, the groom wore a white tuxedo and the couple walked down a white aisle under an archway created by a flag corps to the tune of *Here Comes the Bride* played by a trumpeter. All of this at 6 a.m.!

Think of all the unusual things that can be done with ATV!

Photo E. The wedding drifting toward heaven.

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—CD Review 10/10 Nov.'89
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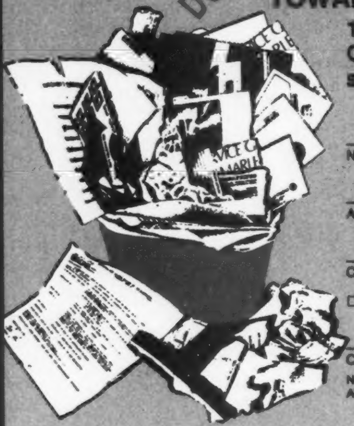

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FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

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2	Never Say Die
3	QRX
4	Omni-Gain Vertical Collinear
5	High on ATV
6	Ham Profiles
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8	Review: AEA FSTV-430A
9	High Altitude Ballooning
10	Review: 1250 MHz ATV Downconverter and Antenna
11	Updates
12	RTTY Loop
13	Hamsats
14	Yaesu Service Survey
15	Review: TDS ATV Transceiver
16	Model Rocket ATV
17	Helicopter ATV
18	73 International
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Number 6 on your Feedback card

HAM PROFILES

There are no "average" hams!

Music, Writing, Business—and Ham Radio

Dwight Kalita, Ph.D., ND8Y composes music on his Yamaha HX-1 synthesizer, co-authors books with doctors, runs his own business, enjoys DXing, and sees an enormous future for amateur radio.

Dwight ND8Y has been a ham for 30 years, since he was 13 years old. He and a couple of friends became interested in amateur radio when they were in high school, and an elmer helped them get started. To Dwight ND8Y, active in the Defiance County ARC, amateur radio is a valuable way to make lasting friendships in the community and all over the world. He's worked 323 countries. "Competing in amateur radio develops skills and a background in electronics," he says, and he's passing his knowledge on to his children. KB8AYB, his 10-year-old son, became licensed at the age of six. The five-year-old isn't ready to take time off from baseball yet to study amateur radio, but he'll have plenty of help when he does.

Dwight Kalita is president of Midwest Microcomputers, his own business, which sells NEC computer printers. With satellite operation, the space shuttle, and packet, he says his hobby is now becoming part of his business, and he's very excited about that.

In conjunction with doctors, ND8Y has co-authored books on health and nutrition, such as *Victory Over Diabetes, Brain Allergies, Nourishing Your Child*, and the *Physician's Handbook on Orthomolecular Medicine*.

As a musician, his *Kalitascope of Synthesizer Music* CD is one of the best sellers of Music New Hampshire. After about a year and a half of a lot of "work, fun, and love" ND8Y sent his 44.1 kHz DAT recording tape to Wayne Green and "hit a home run."

New Rig Needed—Maybe Two!

Andy Robinson KA3WDW is one of the newest and youngest hams on the air. This nine-year-old passed both code and theory exams for the Novice Class license on his first try. Andy says he wants to work on his WAS and DXCC now. His father, George Robinson WA3LVR, says, "Looks like I better think about replacing my 16-year-old Heath gear. Between Andy and me, there's going to be a lot of hours put on the rig."

Andy's father promised him that if Andy passed his Novice, he would take his Extra. So guess who has his nose in the Extra study guide? "This is definitely what I call incentive licensing," says WA3LVR, "and it is my pleasure to be doing it!"

Andy KA3WDW turned nine on March 1 and passed his Novice exams on March 21. He's in third grade in Beaver Creek Elementary School. Besides ham radio, he also enjoys playing Little League baseball. He plays third base and outfield for the Caln Minor A Phillies.

Currently, Andy is studying for the Technician Class exams, and he says he wants to go all the way to Extra. "I can't tell you how proud I am of him," his father says. "It's a lot of work for a nine-year-old. I hope he gets as much enjoyment out of ham radio as I have."

Meanwhile, in Alaska

Last winter, Jack R. Bitzer NL7SX successfully elmered his three children, Bryn, Elizabeth, and Sarah. For several months they used the Commodore 64 computer and a Morse cartridge to learn and practice code, and the ARRL's *Tune in the World*, accompanied by coaching from their mother, to study theory. They also used the code tapes that come with *Tune In*. W5YI examiners Mary KL7JEF, Bob KL7NC, and Gene AL7KH gave the children their Novice exams last April. Now the three are also known as Bryn WL7BXQ (11-years-old), Elizabeth WL7BXR (10-years-old), and Sarah WL7BXS (11-years-old). It wasn't easy, but the children are glad they did it! Their Novice licenses expire on April 17, 2000.

Sarah's first QSO was with Trevor VK4AFL in Brisbane, Australia. This has stimulated her interest to learn more about other cultures and places.

Bryn's first contact was QRP with AL7KH, four miles away. Later, he enjoyed a trip with NL7SX to string a wire between two mountains, and it sounds like he might enjoy more such expeditions.

Elizabeth's first QSO was with 14-year-old Jonathon KA5LXA in Baton Rouge, Louisiana, quickly followed by Jonathon's elmer, Doug KA5YSY, then Doug's wife, Judy KB5ACA. Elizabeth types 25 wpm, and she's presently observing the operation of BBS KL7NC for possible packet operation, as soon as KL7NC puts a transmitter on the 10m Novice band this summer.

The children use an HTX-100 and ICOM 735 for 10m USB, and a DX-60 B transmitter and DX-302 receiver for 80m, 40m, and 15m CW.

Jack NL7SX, who has been a ham since he was sixteen, and his three children are four of the nine hams in Ketchikan.

NL7SX
WL7BXS
WL7BXQ
WL7BXR

Low Power Two Meter FM Transmitter

Inexpensive, lightweight and expendable!

by Carl Lyster WA4ADG

After my balloon flight honoring the 20th anniversary of Apollo 11, I decided to design a simple 2 meter FM transmitter that could be built cheaply enough to be considered expendable. It needed to be lightweight, to provide a few hundred milliwatts output at best and be reproducible with few headaches. The circuit described here meets all of these requirements and performs better than my expectations. The complete unit measures 2″ x 4″, weighs under two ounces, provides 225 mW of output and is rugged and stable over a voltage range of 9 to 12 VDC.

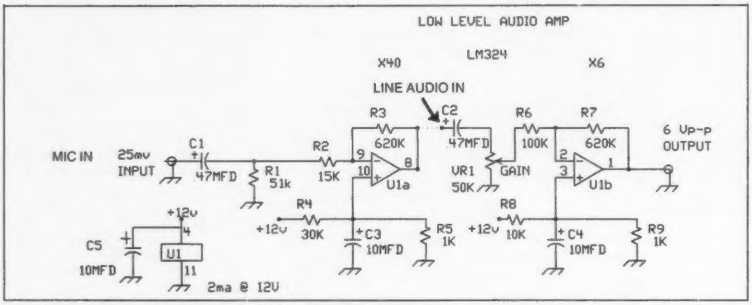
LOW LEVEL AUDIO AMP
LM324
X40
X6
LINE AUDIO IN
MIC IN
25mv INPUT
C1
47MFD
R1
51k
R2
15K
R3
620K
9
10
8
U1a
C2
47MFD
VR1
50K
GAIN
R6
100K
R7
620K
2
3
1
U1b
6 Vp-p OUTPUT
R4
30K
+12v
C3
10MFD
R5
1K
R8
10K
C4
10MFD
R9
1K
+12v
4
U1
11
C5
10MFD
2ma @ 12V

Figure 1. Audio amplifier circuit for microphone or line audio input.

When designing this device I chose several components that I knew from previous experience would perform well at 2 meters: a 2N3866 transistor for a final, 2N5179s for the multipliers, double-tuned toroidal forms for the tanks, and an X12 frequency multiplication scheme that would allow the use of Drake TR-22 type transmit crystals (low-cost and easy to order).

The circuit went through many revisions as I attempted to simplify the test equipment needed to tune up the transmitter. I spent many days in front of a spectrum analyzer trying to optimize the values of the tuned circuits to prevent accidental generation of spurs. The value of each resonant inductance was chosen so that the associated trim cap would be unlikely to resonate on the wrong multiple. This transmitter is not foolproof but it should be easily adjustable by anyone with patience and some good luck!

Audio Section

The transmitter requires a 6 Vp-p audio input level to obtain 5 kHz deviation. It was originally designed to interface directly with my digitized voice ID circuit in *Ham Radio*, Feb. '89. However, if you want to use a microphone or other low level audio source, use the circuit in Figure 1. This audio amplifier provides the necessary 6 Vp-p output while consuming only 2 mA from the 12 volt supply. Two sections of an LM324 quad op-amp are used to implement the amplifier. The first stage is set for a gain of 40 and is capacitively coupled by C2 to potentiometer VR1 which controls the overall amplifier gain. The second stage is set for a gain of 6 and its output is fed directly to the transmitter through a low-pass filter externally mounted between the audio amplifier and the transmitter input (C12 and R9 in Figure 4). The gain of these two stages was chosen so that the last stage could be used by itself if a higher level source of audio is available. By opening the trace from pin 8 to C2, an external signal of about 1 volt or better can be injected into the positive terminal of C2. If you experience low frequency rolloff in your transmitter with this amplifier, you might try increasing the value of C11, the DC blocking capacitor in the external low-pass filter (Figure 4.)

The Transmitter Circuit

Transistor Q1 forms the 12 MHz oscillator and crystal Y1 is set on frequency by trim cap C1 (Figure 4). Zener diode D1 regulates the

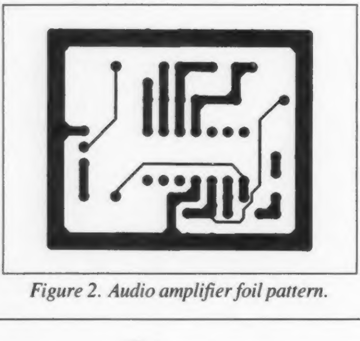

Figure 2. Audio amplifier foil pattern.

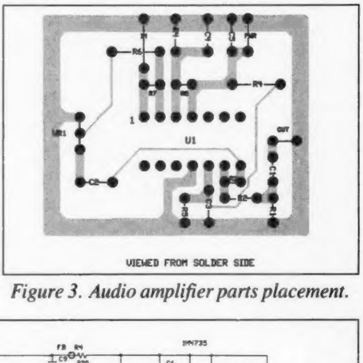
R6
R4
R7
R8
1
VR1
U1
OUT
C2
C3
R5
R2
R9
C4
C1
PWR
VIEWED FROM SOLDER SIDE

Figure 3. Audio amplifier parts placement.

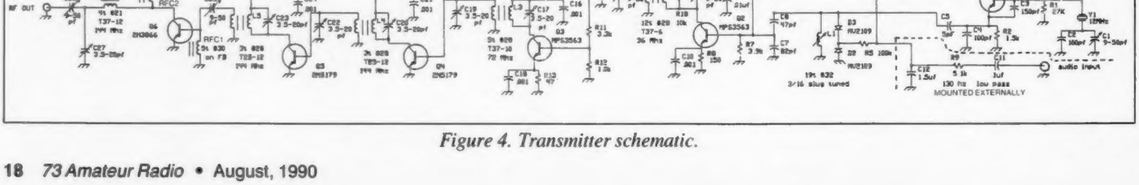
+12Vdc max
RF OUT
C28
9-50 pf
C27
3.5-20pf
L6
4t #21
T37-12
144 MHz
C26
.001
R17
100
5t #30 on FB
RFC2
Q6
2N3866
RFC1
5t #30 on FB
C25
9-50 pf
3t #28
T25-12
144 MHz
R16
100
FB
C24
.001
L5
C23
3.5-20pf
Q5
2N5179
C22
3.5-20 pf
3t #28
T25-12
144 MHz
R15
1200
FB
C21
.001
L4
C20
3.5-20pf
Q4
2N5179
C19
3.5-20 pf
5t #28
T37-10
72 MHz
R14
470
FB
L3
C17
3.5-20 pf
C16
.001
Q3
MPS3563
C18
.001
R13
47
R19
10k
C15
9-50 pf
R11
3.3k
R12
1.0k
12t #28
T37-6
36 MHz
R10
100
FB
L2
C14
9-50 pf
C13
.01uf
R18
10k
Q2
MPS3563
C10
.001
R8
150
R6
27k
R7
3.3k
C8
47pf
C7
82pf
L1
19t #32
3/16 slug tuned
D3
MV2109
D2
MV2109
R5
100k
FB
R4
220
C9
.01uf
VR1
100k
C6
1uf
D1
1N4735
Q1
MPS3563
R3
39K
C3
150pf
R1
27K
C5
5pf
C4
100pf
R2
1.5k
Y1
12MHz
C2
100pf
C1
9-50pf
C12
1.5uf
R9
5.1k
C11
1uf
130 Hz low pass
MOUNTED EXTERNALLY
audio input

Figure 4. Transmitter schematic.

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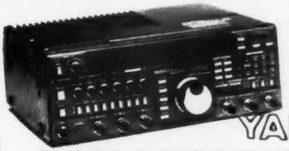

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YAESU	ICOM
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FT411-811-911	IC02AT/32AT
FTC-1903/1123	IC2/4GAT/24AT
FTH-2008/7008	IC-A20/U16

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MAXON, MOTOROLA,
YAESU: FTH 2008/7008
UNIDEN, REGENCY, KING,
MARINE ICOM: M5, M56, M700
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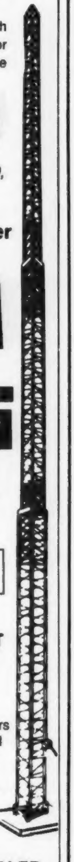

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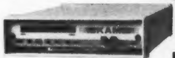

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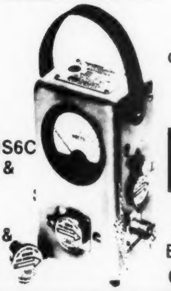

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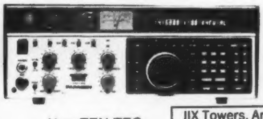

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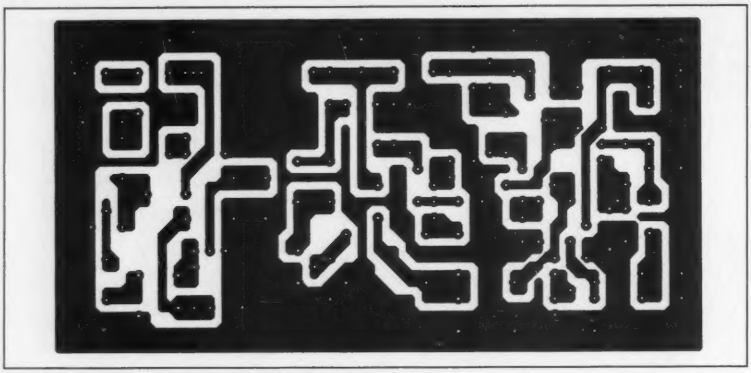

Figure 5. Transmitter foil pattern.

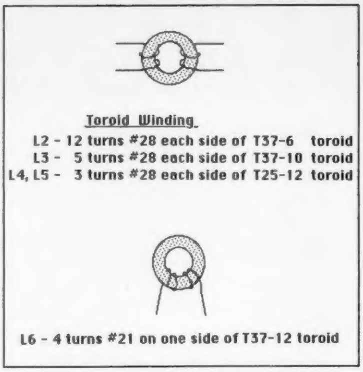
Toroid Winding
L2 - 12 turns #28 each side of T37-6 toroid
L3 - 5 turns #28 each side of T37-10 toroid
L4, L5 - 3 turns #28 each side of T25-12 toroid
L6 - 4 turns #21 on one side of T37-12 toroid

Figure 7. Toroid winding details.

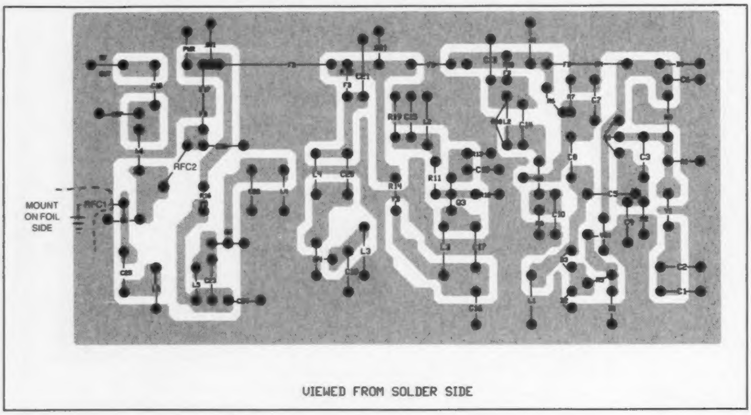

Figure 6. Transmitter parts placement.

power supply for the oscillator to 6.2 VDC for frequency stability. C5 couples the output of the oscillator to the phase modulator composed of L1 and varactor diodes D2 and D3. Pot VR1 sets the DC operating point for the diodes and is summed with the audio input to provide the modulation signal for the varicaps. Since phase modulators are sensitive to both modulation amplitude and frequency, audio is fed into the transmitter through a DC blocking capacitor C11 and an externally mounted low-pass filter composed of C12 and R9. Components C11, C12 and R9 are connected externally between the audio amplifier (or 6 Vp-p audio source) and the transmitter due to the fairly large size of C12. This filter provides the 6 dB per octave rolloff needed to maintain an equal deviation versus frequency response. About 6 Vp-p of audio is required to give 5 kHz of deviation.

The modulated 12 MHz signal is applied to Q2 where it is tripled to 36 MHz. Tank L2 is composed of 12 turns of wire on both primary and secondary and has its Q dampened by 10k ohm resistors on each.

The trim caps on this tank (C14 and C15) tune very sharply and must be adjusted with care. Q2 produces excessive 36 MHz energy so a voltage divider, composed of R11 and R12, drops the 36 MHz level applied to the base of Q3, the first class-C multiplier.

Tank L3 resonates at 72 MHz and is composed of 5 turns of #28 on each winding. Q4 is the first 2N5179 multiplier. The MPS3563 transistors don't perform well above 100 MHz so they are used only for the low frequency multipliers. Q4's tank resonates at 144 MHz and is composed of 3 turns each of #28 wire. There is an output of about 5 mW here but it lacks spectral purity.

Q5 is a low power amp that adds greatly to the purity of the final output. Its tank is also composed of 3 turns of #28 on each winding. About 20 mW of output is available here. Q6 is the final and is limited to just over 200 mW output by resistor R17. I do not recommend attempting to get higher power output by changing this resistor because you're bound to get instability.

Trim caps C28 and C27 match the output to a 50 ohm load and tune somewhat broadly. Two RF chokes composed of 5 turns of #30 wire on a small ferrite bead are used as a DC collector supply and a DC path to ground for the base of Q6. Other ferrite beads are used throughout the circuit for supply isolation.

Tune-Up

You need some basic test equipment to get any home-brew transmitter up and running. I would recommend a grid dip meter and a frequency counter as a bare minimum. Start by installing a crystal of your choice and a low-power 50 ohm dummy load at the output. Apply +12 volts and check for oscillation at Q1. This can be done by connecting a counter across L1.

Transmitter Parts List

C1,C14,C15,C28, C17,C19,C20,C25	9–50 pF trim cap
C22,C23,C27	3.5–20 pF trim cap
C3	150 pF disk cap
C4	100 pF disk cap
C5	5 pF disk cap
C6,C11	0.1 MFD monolithic cap
C12	1.5 MFD cap
C9,C13	0.01 MFD disk cap
C8	47 pF disk cap
C7	82 pF disk cap
C10,C16,C18, C21,C24,C26	0.001 µF disk cap
Q1,Q2,Q3	MPS3563
Q4,Q5	2N5179
Q6	2N3866
D1	1N4735 zener
D2,D3	MV2109 varicap
R1,R6	27k ¼ watt
R2	1.5k ¼ watt
R3	39k ¼ watt
R4	220Ω ¼ watt
R5	100k ¼ watt
R7	3.9k ¼ watt
R8	150Ω ¼ watt
R9	5.1k ¼ watt
R10,R16,R17	100Ω ¼ watt
R11	3.3k ¼ watt
R12	1.0k ¼ watt
R13	47Ω ¼ watt
R14	470Ω ¼ watt
R15	1.2k ¼ watt
R18,R19	10k ¼ watt
VR1	100k trimpot
L1	19T #32 on 3/16″ slug-tuned form
L2	12T each winding of #28 on T37-6
L3	5T each winding of #28 on T37-10
L4,L5	3T each winding of #28 on T25-12
L6	4T of #21 on T37-12 core
RFC1,RFC2	5T of #30 wound on Ferrite Bead
FB	6 Ferrite Beads
Y1	Drake TR-22 xmit crystal

Audio Amplifier Parts List

U1	LM324 op-amp
C1,C2	0.47 µF/35V Elect.
C3,C4,C5	10 µF/35V Elect.
VR1	50k trimpot
R1	51k ¼ watt
R2	15k ¼ watt
R3,R7	620k ¼ watt
R4	30k ¼ watt
R5,R9	1k ¼ watt
R6	100k ¼ watt
R8	10k ¼ watt

Blank PC Boards are available from FAR Circuits, 18N640 Field Court, Dundee, IL 60118. Toroid cores and ferrite beads are available from Radiokit, P.O. Box 973-C, Pelham NH 03076. Phone: (603) 635–2235. Crystal Y1 can be obtained from KW Crystals, P.O Box 508, Prague OK 74864. Phone: (405) 567–2285 or JAN Crystals, P.O. Box 6017, Fort Myers FL 33906-6017. Phone: (813) 936–1404. All other components can be obtained from Circuit Specialists, P.O. Box 3047, Scottsdale, AZ 85271-3047. Phone: (800) 528–1417.

An alternative for the slug-tuned coil L1 is J.W. Miller part # 23A336RPC (2.40-4.10 µH) also available from Circuit Specialists.

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12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout

Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-A** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-A

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Bands: 29-54, 118-174, 406-512, 806-912 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.

The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¼" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-A** is available for $178.95.

Bearcat® 145XL-A

List price $189.95/**CE price $94.95/SPECIAL**

10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC

Bands: 29-54, 136-174, 406-512 MHz.

The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-A** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

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10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • Preprogrammed 10 KHz. Channels

Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.

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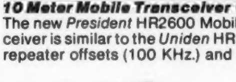
List price $599.95/**CE price $299.95/SPECIAL**

10 Meter Mobile Transceiver • New Features

The new *President* HR2600 Mobile 10 Meter Transceiver is similar to the *Uniden* HR2510 but now has repeater offsets (100 KHz.) and CTCSS encode.



BC760XLT
800 MHz.
mobile scanner
SPECIAL!

★★★ *Extended Service Contract* ★★★

If you purchase a scanner, CB, radar detector or cordless phone from any store in the U.S. or Canada within the last 30 days, you can get up to four years of extended service contract from Warrantech. This service extension plan begins *after* the manufacturer's warranty expires. Warrantech will perform all necessary labor and will not charge for return shipping. Extended service contracts are not refundable and apply only to the original purchaser. Warrantech does *not* have an extended warranty plan for *handheld* scanners. For mobile or base scanners, CB radios or radar detectors a 1 year extended warranty is $19.99, two years is $39.99 and four years is $59.99. Order your service contract today.

OTHER RADIOS AND ACCESSORIES

BC55XLT-A *Bearcat* 10 channel scanner	$114.95
AD100-A Plug in wall charger for BC55XLT	$14.95
PS001-A Cigarette lighter cable for BC55XLT	$14.95
VC001-A Carrying case for BC55XLT	$14.95
AT054-A Replacement antenna for BC55XLT	$14.95
BC70XLT-A *Bearcat* 20 channel scanner	$159.95
BC175XLT-A1 *Bearcat* 16 channel scanner	$134.95
BC1-A *Bearcat* Information scanner with CB	$129.95
INF7-A *Regency* Information Radio	$109.95
INF10-A *Regency* Information Radio	$109.95
INF50-A *Regency* Information Radio	$109.95
UC102-A *Regency* VHF 2 ch. 1 Watt transceiver	$114.95
VM200XL-A *Uniden* Video monitoring system	$179.95
BP205-A Ni-Cad batt. pack for BC200/BC100XLT	$39.95
FBE-A Frequency Directory for Eastern U.S.A.	$14.95
FBW-A Frequency Directory for Western U.S.A.	$14.95
RFD1-A MI, IL, IN, KY, OH, WI Frequency Directory	$14.95
RFD2-A CT, ME, MA, NH, RI, VT Directory	$14.95
RFD3-A DE, DC, MD, NJ, NY, PA, VA, WV Dir.	$14.95
RFD4-A AL, AR, FL, GA, LA, MS, NC, PR, SC, TN, VI	$14.95
RFD5-A AK, ID, IA, MN, MT, NE, ND, OR, SD, WA, WY	$14.95
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CBH-A Big CB Handbook/AM/FM/Freeband	$14.95
TIC-A Techniques for Intercepting Communications	$14.95
RRF-A Railroad frequency directory	$14.95
EEC-A Embassy & Espionage Communications	$14.95
CIE-A Covert Intelligence, Elect. Eavesdropping	$14.95
MFF-A Midwest Federal Frequency directory	$14.95
A60-A Magnet mount mobile scanner antenna	$34.95
A70-A Base station scanner antenna	$34.95
USAMM-A Mag mount VHF ant. w/ 12' cable	$39.95
USAK-A ¾" hole mount VHF ant. w/ 17' cable	$34.95

Add $4.00 shipping for all *accessories* ordered at the same time. Add $12.00 shipping per radio and $4.00 per antenna.

BUY WITH CONFIDENCE

To ***get the fastest delivery from CEI*** of any scanner, send or phone your order directly to our Scanner Distribution Center.™ Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. On all credit card orders, the ship to address must *exactly* match the credit card billing address. If the billing address is a P.O. Box or a P.O. Box Zip® Code, UPS can not deliver to that address. When this occurs, the order must be shipped by mail at a higher cost to you. To avoid this extra charge, you may mail us a check with your order. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on backorder automatically or equivalent product substituted unless CEI is instructed differently. A $5.00 additional handling fee will be charged for all orders with a merchandise total under $50.00. Shipments are F.O.B. CEI warehouse in Ann Arbor, Michigan. No COD's. Most items listed have a manufacturer's warranty. Free copies of warranties on these products are available by writing to CEI. Non-certified checks require clearance. Not responsible for typographical errors.

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CIRCLE 121 ON READER SERVICE CARD

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TNT/THE NEW TUBE
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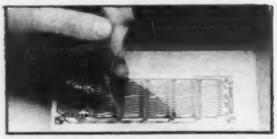
CIRCLE 94 ON READER SERVICE CARD

MAKE CIRCUIT BOARDS THE NEW, EASY WAY



WITH TEC-200 FILM

JUST 3 EASY STEPS:
- Copy circuit pattern on TEC-200 film using any plain paper copier
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- Peel off film and etch

convenient 8½ × 11 size
With Complete Instructions
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If You're Serious About Radios You Want The Best Batteries!

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N 600	"AA"	$1.50 Ea.
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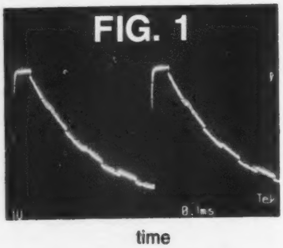
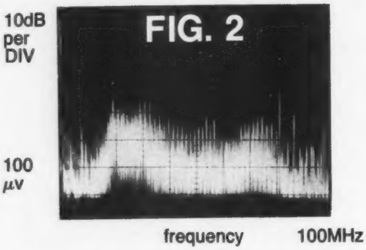
CIRCLE 62 ON READER SERVICE CARD

! STOP !

COMPUTER RADIATION

Have you ever observed the situation where an electric device is adversely affected by a nearby computer? We look at the waveform in the time domain and think we understand it.





The scope photos show the wave form being conducted by ribbon between shielded circuit and keyboard within a computer, in both time (fig. 1) and frequency (fig. 2) domain. The Spectrum Probe is placed directly on the line and has no effect on the waveform because of the low capacity input. Clock and waveform harmonics are low — but unnecessary spurious is radiated by this lead up to about 70MHz.

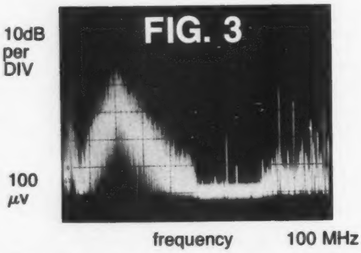


Fig. 3 shows the waveform being connected to the outside world (read "radiated") by a rear panel connnector. There is no digital information present, yet there is extremely high and completely unnecessary spurious energy at about 20MHz. Most spectral lines above 50MHz are due to residual pickup of RF, even without connecting an exterior lead, indicating that a reasonably good radiating antenna is present!

107 SPECTRUM PROBE
converts any scope into a
100MHz spectrum analyzer

$199 direct
Smith Design 1324 Harris Rd.
Dresher, PA 19025 (215) 643-6340

CIRCLE 85 ON READER SERVICE CARD

Once oscillation is confirmed, loosely couple a grid dipper adjusted to 36 MHz to L2. Adjust L1 with VR1 in center position for a maximum reading on the dipper being used as a tuned RF voltmeter. Adjust C14 for maximum reading. About 1.1 VDC should be present at the emitter of Q2. Set the dipper for 72 MHz and couple it to L3. Adjust C15 and C17 for maximum indication on the dip meter. About 0.05 VDC should be at the emitter of Q3. Move the dipper to L4 and adjust C19 and C20 for maximum energy at 144 MHz. Move the dipper to L5 and adjust C22 and C23 for maximum signal at 144 MHz. You should be able to see some output at the 50 ohm load by now. Adjust C25, C27 and C28 for maximum output. Go back and retouch C14 through C28 for maximum. There should be a minimum of 100 mW output. Apply 6 Vp-p of 1000 Hz audio to the input of the low-pass filter.

Use a 2 meter rig as a monitor and adjust L1 to VR1 for the best-sounding audio. If possible, use an oscilloscope to monitor the shape of the received sine wave and adjust L1 and VR1 for best reproduction. These two adjustments interact quite a bit so jockey back and forth to obtain the best possible signal. Also, set the transmitter on frequency by adjusting C1.

If you monitor the unmodulated transmitter on a nearby receiver you can detect spurious outputs from a maladjusted transmitter. It is always a good idea to have a 2 meter rig on when making these adjustments. Any bizarre chirps or fluctuations in the received signal are a sure indication that a stage is in oscillation and needs to be rechecked. If at all possible, have your transmitter checked on a spectrum analyzer to be absolutely sure that no unwanted spurs are being emitted. Most of the units that I have built have no detectable spurs 50 dB down from the main carrier. Your particular transmitter may require additional filtering to meet FCC specs. The average weight for these transmitters is about 1.5 oz. with 170 mW of output at 12 VDC. The current consumption is about 100 mA.

Good tinkering! 73

Number 11 on your Feedback card

UPDATES

Two Meter Portable Quad —Correction

Charles W. Pearce, Ph.D., K3YWY, author of the above article in the June 1990 issue, has sent us a correction.

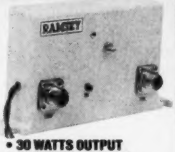
Refer to Table 2 on page 24. The spacers listed as 3.5″ should be 4.5″. Thank you, K3YWY, for the update. 73

★ ALL NEW KITS ★

RAMSEY ELECTRONICS

Quality Test Gear & Electronic Kits for Professionals and Hobbyists

2 MTR & 220 BOOSTER AMP



Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output allowing you to hit the repeaters full quieting while the low noise preamp remarkably improves receptions. Ramsey Electronics has sold thousands of 2 mtr amp kits but now, we offer completely wired and tested 2 mtr as well 220 MHz units. Both have all the features of the high priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $79.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $79.95

- **30 WATTS OUTPUT**
- **LOW NOISE PREAMP**
- **LOW COST**
- **RUGGED CAST ALUMINUM CASE**
- **ONE YEAR WARRANTY**

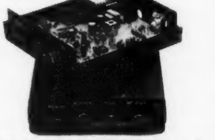
PERSONAL SPEED RADAR

SPEEDY
SPEEDY

Complete kit, SG-7 **$89.95**

New low cost microwave doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners or virtually anything that moves. Operates at 2.6 GHz with over 1/4 mile range. LED digital readout displays speeds in miles per hour, kilometers per hour or feet per second! Earphone output permits listening to actual doppler shift. Uses two 1 lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

RADIOS



20, 40 & 80 METERS HAM RECEIVERS

Sensitive all mode, AM, CW, SSB receivers for 3.5—4.0 or 7.0—7.5 MHz. Direct conversion design using NE602 IC as featured in QST and ARRL handbooks. Less than 1 μv sensitivity, varactor diode tuned, 50 mw audio output. Runs on 9VDC, has RF gain control. This kit is very easy to build, lots of fun and educational—ideal for the beginner or the old pro. The optional matching case kit features a rugged ABS plastic case with screened graphics. Included are machined aluminum knobs for a well-finished professional look.

20 MTR receiver kit HR-2 **$24.95** 40 MTR receiver kit HR-4 **$24.95** 80 MTR receiver kit HR-8 **$24.95** Receiver case CHR **$12.95**

QRP TRANSMITTER KITS, 20, 40 & 80 METERS

Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

20 MTR QRP Kit QRP-20 **$29.95** 40 MTR QRP kit QRP-40 **$29.95** 80 MTR QRP kit QRP-80 **$29.95** Case kit CORP **$12.95**

AIRCRAFT RECEIVER KIT

Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

Complete kit, AR-1 **$24.95** Receiver case kit, CAR-1 **$12.95**

SHORTWAVE RECEIVER KIT

A fantastic receiver that captures the world with just a 12" antenna! Receives 4—11 MHz in 2 MHz bands, varactor tuned, superhet design with AGC, RF gain control, and 50 mw audio output. Uses new Signetics mixer chip for less than a microvolt sensitivity, runs on 9V battery. This is a fascinating scout, school or club project, and will provide hours of fun even to the most serious DX'er. Add the optional case kit and you have a real nice looking shortwave set.

Complete kit, SR-1 **$24.95** Receiver case kit, CSR-1 **$12.95**

PACKET RADIO

Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software, PC board, all necessary parts and full documentation.

Complete kit, PC-1 **$49.95**

FM COMMUNICATIONS/ 2 MTR, 10 MTR & 220 RECEIVERS

Sensitive superhet FM receiver tunes any 5 MHz segment of band. Listen to ham operations, high band police calls, weather or mobile phone calls! Easy to build receiver features varactor tuning, IC mixer stage, ceramic IF filters and dual conversion design with adjustable squelch. Less than 1 μv sensitivity, runs on 9 V battery, with 50 mw audio output. Optional ABS case with screened graphics and machined aluminum knobs provide a nice professional look.

2 MTR kit FR-7 **$29.95** 10 MTR kit FR-10 **$29.95** 220 MHz kit FR-20 **$29.95** Receiver case kit CFR-7 **$12.95**

NEW MINIKITS—NEW MINIKITS

BROADBAND PREAMP

A sensitive all purpose preamp, ideal for scanners, TV sets, VHF, UHF rigs, counters, etc. Features low noise, 4 db NF, 20 db gain, 100 KHz—1 GHz operation. Runs on 9—12 VDC, 50 ohms input.

Complete kit, SA-7 **$14.95**

LIGHT BEAM COMMUNICATORS

Transmits modulated infrared light up to 30 feet without lenses, up to 1/4 mile using lenses. Uses 30 KHz carrier for hum-free operation, transmits thru windows, etc. Ideal for "bugs" or listening to IR remote controls. Transmitter has sensitive mike input, receiver uses PIN detector and drives speaker output. Units operates on 9—12 VDC.

Transmitter kit, LB-6 **$8.95**
Receiver kit, LB-5 **$9.95**

HIGH POWER FM WIRELESS MIKE

A high power unit that will transmit up to 1/2 mile to any FM broadcast radio. Sensitive input accepts any type of mike, will pick up normal voices 10 feet away using the available mini-electric mike cartridge. Operates on 9—12 VDC

FM-4 kit **$12.95**
Sensitive microphone cartridge **$2.95**

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp • 3 db NF

$49.95 wired includes AC adapter
PR-2 kit $39.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiples Up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

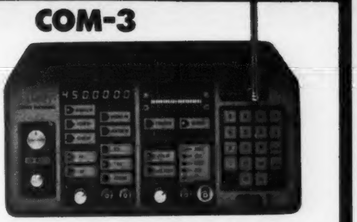
$69.95 wired
PS-2 kit $49.95

PS-10B 1.5 GHz PRESCALER

Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

$89.95 wired includes AC adapter

COM-3



$2795.00

THE COMMUNICATIONS SERVICE MONITOR THAT WORKS HARDER FOR LESS.

Introducing COM-3... the new service monitor designed by service technicians for service technicians. It works harder for less... giving you advanced testing capabilities at a very affordable price. FEATURES • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10,000 μv output levels • High receive sensitivity, less than 5 μv • 100 KHz to 999.9995 MHz Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder, 1 KHz and external modulation

MINI KITS—EASY TO ASSEMBLE—FUN TO USE

TONE DECODER
A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 **$5.95**

COLOR ORGAN
See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110VAC.
ML-1 Kit, **$8.95**

VIDEO MODULATOR
Converts any TV to video monitor. Super stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, JM-7 **$12.95**

FM WIRELESS MIKE

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.
FM-1 Kit **$5.95**
FM-2 Kit **$7.95**

LED BLINKY KIT
Alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts.
BL-1 Kit, **$3.95**

MAD BLASTER
Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC
MB-1 Kit **$4.95**

40 WATT 2 mtr PWR AMP
Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W, incredible value, complete with all parts, less case and T-R relay.
PA-1, 40 W pwr amp kit **$27.95**
TR-1, RF sensed T-R relay kit **6.95**

VOICE ACTIVATED SWITCH
Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 9 VDC.
VS-1 KIT **$6.95**

UNIVERSAL TIMER
Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.
UT-5 Kit **$5.95**

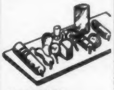
WHISPER LIGHT
An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.
WL-1 Kit **$6.95**

SIREN
Produces upward and downward wail. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 **$3.95**

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
BN-9 Kit **$5.95**

60 Hz TIME BASE
Runs on 5-15 VDC. Low current (25ma) 1 min/month accuracy
TB-6 Kit **$5.50**
TB-6 Assy. **$9.95**

TELEPHONE TRANSMITTER
Low cost with professional performance. Features include; self phone line powered, tunable from 76 to 100 MHz, polarity antisensitive, compact size (½" x 1¼"), easily installs anywhere on the phone line or inside the instrument itself.
PB-1 KIT **$14.95**



FM RECEIVER
For built-in applications or hobby experimentation. Full fledged superhetrodyne receiver, microvolt sensitivity, 10.7 MHz IF, Integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception
FR-1 KIT **$14.95**

FM MINI MIKE
A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.
FM-3 Kit **$16.95**
FM-3 Wired and Tested **19.95**

NEW

MICROWAVE INTRUSION ALARM
A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.
Complete Kit, MD-3 **$16.95**

NEW

SPEECH SCRAMBLER
Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC DBM circuitry. Can also be used to descramble most com. scramblers.
Complete kit, SS-7 **$29.95**
Case kit, CSS-7 **12.95**

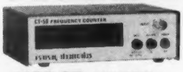
CT-70 7 DIGIT 525 MHz

$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz

$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz



$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz

$189.95 WIRED INCLUDES AC ADAPTER

FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at break-through prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 Mhz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

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CIRCLE 34 ON READER SERVICE CARD

Number 8 on your Feedback card

73 Review

by Hap Griffin WA4UMU and Gerald Cromer K4NHN

The AEA FSTV-430A

A new ATV transceiver.

Advanced Electronic Applications, Inc.
2006-196th St. SW/P.O. Box 2160
Lynnwood WA 98036
(206) 775-7373
Price Class: $440

Fast-scan television (FSTV) has always been one of amateur radio's lesser-known modes. It is usually thought of as being one of those "esoteric" areas best left to the tinkerers and experimenters. Recently, though, the proliferation of VCRs and camcorders has made many hams think about what fun it would be to transmit live color video and sound, as well as home movies, to others. The full-page color ads from AEA, seen for the last year in all the major ham publications, make the idea seem even more attractive. It is no wonder that amateur television (ATV) activity has grown tremendously. The standing-room-only attendance at the Dayton ATV conferences this year is clear testimony to the new interest in this fascinating mode.

Some History

The ATV market has been dominated for the last two decades by two or three relatively small vendors. Occasionally we would see hints of interest from a large manufacturer (such as ICOM's ATV adapter for their IC-1271 33cm rig), but no firm commitments.

Last year, things changed. AEA, having earned a well-deserved reputation for being an innovator in the digital areas of the amateur radio marketplace, saw the potential for amateur television. They had been testing the water for some time by asking questions concerning VCR and TV camera ownership on their equipment warranty cards. Apparently the time was right to make a move into this nearly untapped communication mode. The first rumors that a major equipment manufacturer was about to come out with a radical new rig were heard at the 1988 Dayton ATV workshop. In early 1989 rumor became reality with the introduction of the AEA FSTV-430 transceiver.

Photo A. Front view of the AEA FSTV-430A.

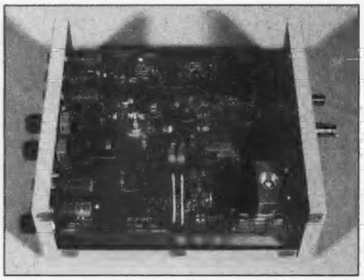

Photo B. Top view of the interior. The circuitry appears simpler than it really is.

Table 1. Measured Video Parameters

Differential Gain	4%
Differential Phase	7°
2T Pulse K-Factor	2.7% Kf
Pulse/Bar Ratio	104%
Luminance/ Chrominance Gain	127%
Luminance/ Chrominance Delay	175 Nanoseconds

This new rig was similar in size, power, and operation to the other two ATV transceivers on the market. What set it apart from (and, in our opinion, above) the crowd was its unique "vestigial sideband" output.

In VSB operation the wideband, amplitude-modulated video signal is filtered to drastically reduce the power in the lower sideband. The filtering is tailored to not remove the entire sideband (as in SSB) but to leave a "vestigial" part of it just below the carrier frequency. The reasons for doing this are complicated, but suffice it to say that VSB is the way it is done in broadcast television. The other two manufacturers simply amplitude modulate the video signal, mixed together with a 4.5 MHz FM sound subcarrier, and send it to the antenna with both sidebands intact and at close to the same amplitude.

Being in the broadcast industry and working with commercial television transmitters on a daily basis, Gerald and I have always tried to "do it right" when it came to designing and building home-brew ATV gear. Designing a transmitter for vestigial sideband operation is more demanding, complicated, and expen-

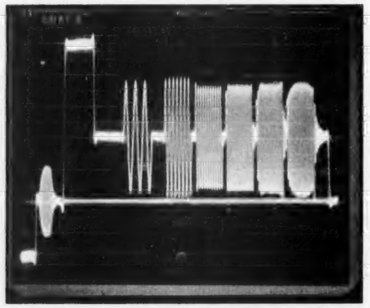

Photo C. Demodulated multiburst test signal. Frequency response is excellent.

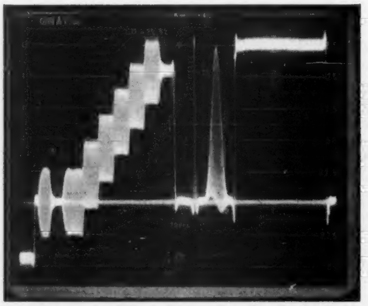

Photo D. Demodulated composite test signal.

sive than simply doing it the totally AM way, but you are rewarded with reports of outstandingly clear audio and "clean" tuning signals, as well as the knowledge that your transmission is as close as possible to true broadcast standards. Finally, here is a commercially available rig that comes darn close to those ideals.

The AEA FSTV-430A

The current offering from AEA is the new "A" model of the FSTV-430, introduced early this year. It looks and operates identically to the previous version (reviewed in the July 1989 issue of *73* magazine). However, there are several internal changes that make a good rig even better.

The construction is typically AEA: a two-piece, all-metal case with a tan and gray color scheme. Graphics and labels are silk-screened in black and red. The front panel has separate input jacks for microphone and PTT as well as a large 10-pin standard video camera input jack. Push-button switches are provided for power, transmit/receive, selection of two crystal-controlled transmit/receive frequencies, DC power to the 10-pin camera jack, and selection of the video source (front panel camera jack or rear panel RCA jack). Also present are controls for video and audio gain, as well as receiver variable tuning. The rear panel holds a DC power input jack, RCA jacks for auxiliary video and audio inputs, an "F" connector for channel 3 or 4 output to a TV set, and a BNC antenna jack.

The interior construction is very impressive. One large double-sided PC board occupies the entire case. Its neat layout belies the complexity of the circuitry—much of it is surface-mount and stripline technology on the underside of the board. Nice touches abound: clearly silk-screened component labels, silver-mica capacitors in the oscillator circuits, high-Q chip capacitors in the UHF circuits, tantalum capacitors in the video section, socketed crystals, gold-plated push-on RF connectors, a fully shielded BNC connector for output, Aromat T-R relay, machined aluminum block heat sink, etc., etc., etc. It is like a breath of fresh air to finally see commercial quality design come to amateur television.

Details

Referring to the block diagram in Figure 1, the selected video source is routed through the front panel video gain control and into an "expander amp." This stage has a "linearity" pot that is set at the factory to precompensate for any nonlinearity in the stages to follow. Audio input is routed through a variable gain, low noise op-amp circuit.

The heart of the rig has to be the LM-2889 video/audio modulator chip. It handles not only the video IF and audio subcarrier oscillator functions, but the AM and FM modulation of them as well. Video is clamped at the sync pulses by internal circuitry, and depth of modulation is set by an on-board pot. Output from the chip on TV channel 3 or 4 (selectable by a jumper) is routed through an SAW (Surface Acoustic Wave) filter that provides the vestigial sideband filtering.

An ingenious heterodyne scheme is used to upconvert this IF signal to the final operating frequency while, in the receive mode, to downconvert the 70cm receive signal back to this same IF frequency. With this system, your TV set does double duty—it's both a display for the receiver and a monitor for your transmitted signal. *[Ed. note: With this scheme you actually monitor the CH-3 or 4 modulator output before it's upconverted to 70 cm.]* The transceiver is supplied with one or two crystals installed for the more popular ATV frequencies: 421.25, 426.25, 434.0, or 439.25 MHz. Our test rig came set up for 434.0 and 439.25 MHz.

When operating simplex, the receive frequency is automatically the same as your transmit frequency. However, for operating split through a repeater or when just tuning the band for activity, a variable receiver tuning control is provided to give full-band coverage. The rig comes with the IF set to TV channel 3. If you wish to use channel 4, a crystal and jumper change are all that's required.

The receive preamp uses a surface mounted dual-gate GaAsFET (3SK164). Stripline filters are used in both the input and output circuits. The noise figure is advertised at less than 1.5 dB.

The frequency conversion chain is a fine

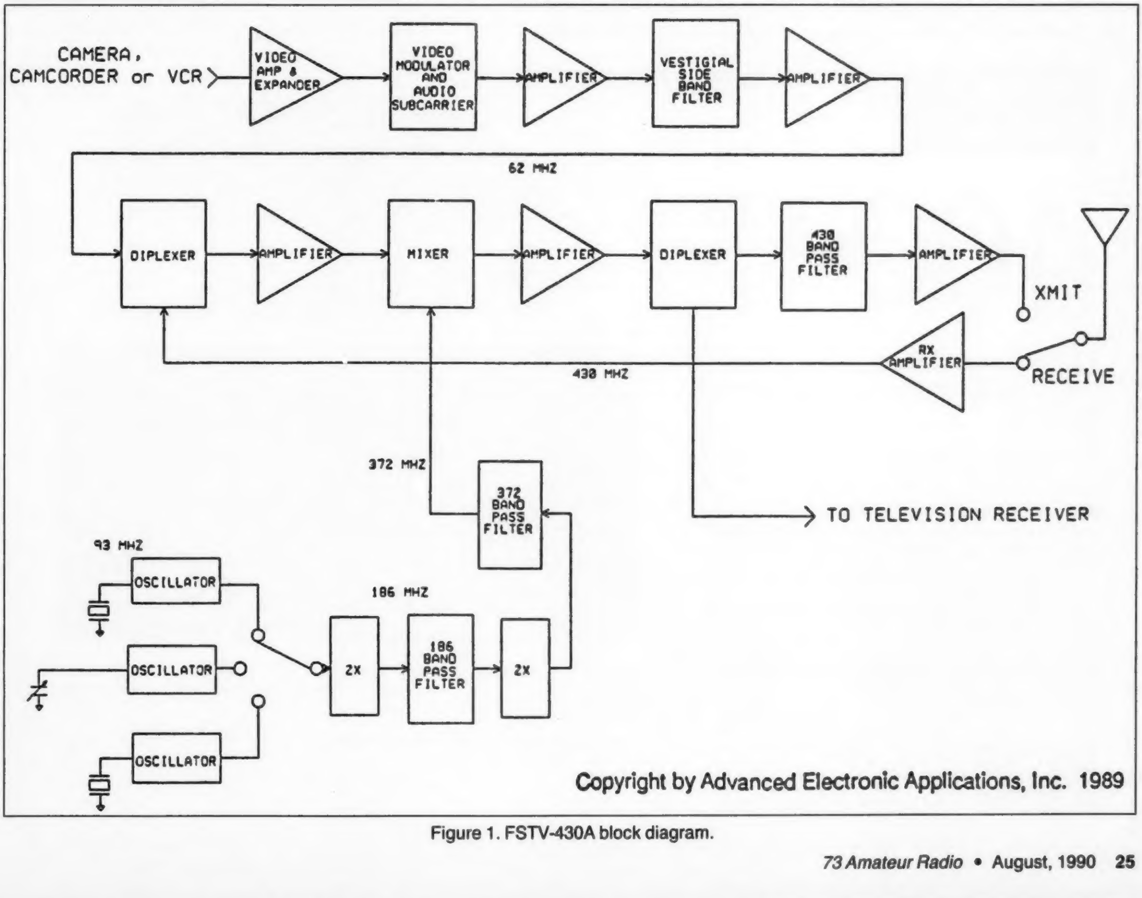

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Figure 1. FSTV-430A block diagram.

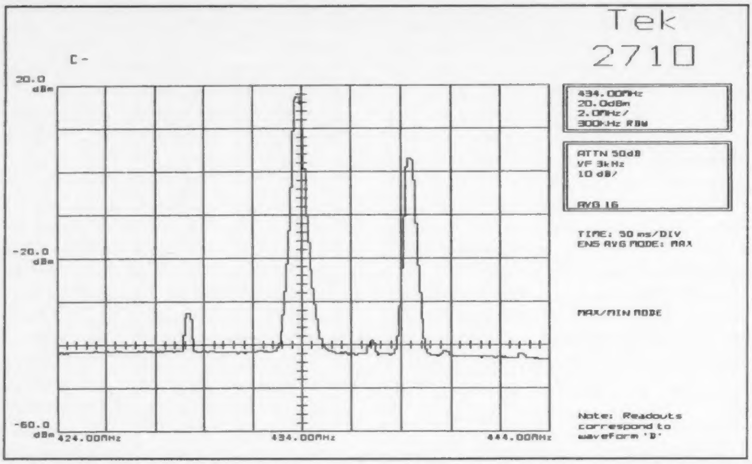

Figure 2. Unmodulated transmitter output. The video carrier is in the center with the aural subcarrier 4.5 MHz higher in frequency and 14.8 dB lower in amplitude. Actual levels are 10 dB higher than indicated due to an attenuator pad used to protect the spectrum analyzer.

example of AEA's up-to-date design philosophy. It uses a pair of diplexer circuits, a doubly-balanced mixer, stripline filters, and a total of six MMICs (Monolithic Microwave Integrated Circuits). The driver and the final linear amplifier stages show strict attention to conservative ratings and linearity, extremely necessary when dealing with vestigial sideband operation. Even though the rig puts out only one watt, the driver is a 3-watt MRF630 and the final is an RF1030, rated for 10 watts! Both stages have regulated bias supplies.

Receiver Performance

Although we have no way to accurately measure the noise figure, receiver performance is identical in A-B comparisons to a P.C. Electronics GaAsFET downconverter that has been in use for several years. Conversion gain was measured at 28 dB at 434 MHz. Frequency accuracy in the crystal mode was good: An input signal of 434.000 MHz produced an IF output on 61.280 MHz. Current draw in the receive mode measured 415 mA in the crystal mode and 450 mA in the variable tuning mode.

Transmitter Performance

With a properly modulated video signal, peak RF output power was measured at +29.2 dBm (0.832 watts). The aural subcarrier measured 14.8 dB below the visual carrier.

Current consumption was 1.30 amps. After 10 minutes of continuous transmitting, peak power dropped slightly to +28.9 dBm (0.776 watts) and current demand rose to 1.33 amps.

Reducing the power supply voltage from 13.8 to 12 volts (simulating battery operation) dropped the peak power output only 0.2 dB, from 0.832 watts to 0.795 watts. Current draw dropped to 1.10 amps. These current levels may seem high for a 1-watt rig, but remember that all amplifier stages are operating class A for best linear operation.

Figure 2 shows the unmodulated transmitter output. The visual carrier is at the center with the aural subcarrier 4.5 MHz higher in frequency. The residual lower sideband aural subcarrier can be seen 4.5 MHz below the visual carrier. The action of the VSB filter is obvious: The lower subcarrier is reduced approximately 36 dB below the level of its upper sideband counterpart. This equates to −52 dBc, which is 10 dB better than the factory spec. (dBc = dB below video carrier). You can see a low amplitude spur about three MHz above the visual carrier but, because it is nearly 60 dB below carrier, its effect is not noticeable. This spur is not present when operating at frequencies other than 434 MHz. The transmitter's second harmonic was relatively

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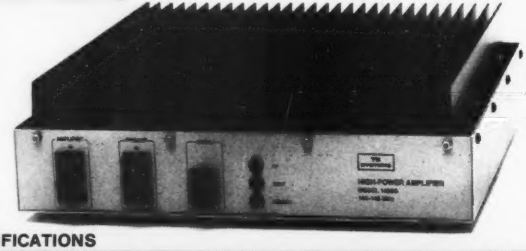

SPECIFICATIONS

Model	Freq. MHz	Power Input	Power Output	Preamp NF-dB	Preamp Gain-dB	DC +Vdc	Power A	RF Conn.
0550G	50-54	10	400	.6	15	13.6	60	UHF
0552G	50-54	25	400	.6	15	13.6	55	UHF
1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	.7	14	13.6	36	UHF
4450G	420-450	10	175	1.1	12	13.6	34	N
4452G	420-450	25	175	1.1	12	13.6	29	N

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Consult your local dealer or send directly for further product information.

Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier. Continuous duty repeater amps also available.

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strong at 25.4 dB below carrier. Several other minor out-of-band spurs were noted, but these were all more than 50 dB down.

At startup, the visual frequency was 434.04 MHz, drifting slightly to 433.96 MHz after 10 minutes of operation. The relative sound subcarrier frequency changed from 4.48 MHz to 4.56 MHz. While seemingly a lot, the drift was not noticeable in actual on-the-air operation. Frequency stability on 439.25 was similar.

Figure 3 shows a video sweep of the transmitter. Vestigial sideband operation is clearly present; the upper sideband response (the area between the visual and aural carriers) is flat to within 3 dB, and the lower sideband more than 1.25 MHz below the visual carrier is greatly reduced.

Because of the design of the SAW filter used, video response extends up to, and even past, the 4.5 MHz sound subcarrier. This wide high-frequency response means that detail and color saturation will be good, but video signals with lots of high frequency content (such as computer generated graphics) may cause sync buzz in the sound. The solution would be to build a simple four MHz low-pass filter for the computer output.

Photo C shows actual demodulated video from a multiburst test signal generator. Frequency response is, in a word, excellent. Photo D shows a composite test signal used to measure several video parameters (see Table 1). These two photographs are not bad for any TV transmitter, especially a piece of amateur gear. We have seen many commercial stations with signals much worse than these!

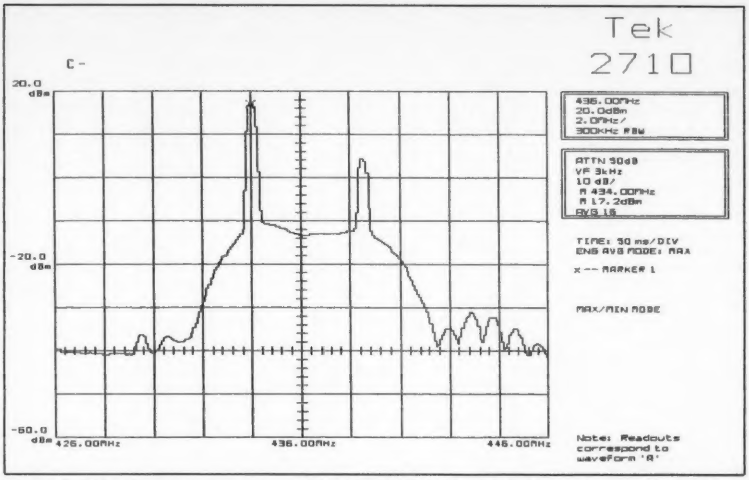

Figure 3. Video frequency response of the FSTV-430A. Vestigial sideband operation is clearly apparent.

Curiously, as the photos show, sync level is only 35 IRE units. This small amount of compression was not in the test gear, so we can only assume it was being reduced from the normal 40 units in the transmitter. This is surprising because the linearity of the rig was excellent (only 4% differential gain). Adjustment of the depth of modulation and linearity pots in the modulator did not seem to help.

Comments

The on-the-air performance of this rig is excellent, adding testimony to the fine results of the technical measurements.

The overall design and appearance of the transceiver are very good, although the front panel silk-screen on our test unit was slightly out of alignment. We would have preferred a standard mike jack instead of the separate miniature phone-type jacks for mike audio and PTT. Although some would prefer a type-N output connector as opposed to the BNC connector supplied, we feel that most users will operate this rig with an external amplifier and that the BNC is entirely appropriate.

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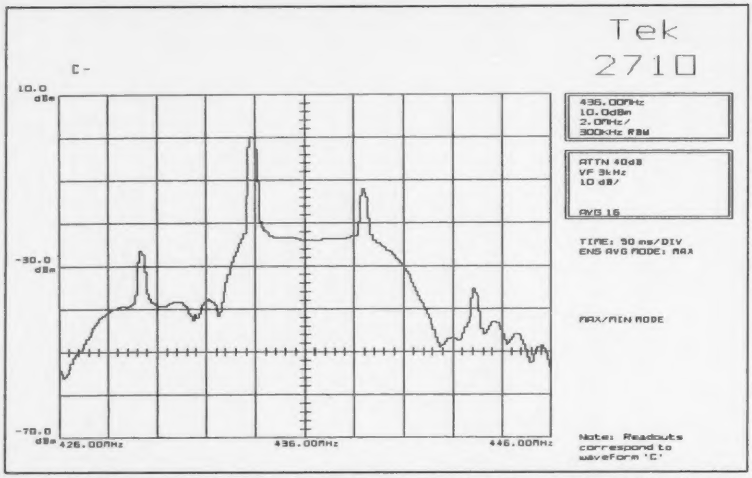

Figure 4. Output sweep of Mirage D24 amplifier being driven by the FSTV-430A. Vestigial sideband response is not as good as in Figure 3 but it is still entirely respectable.

Power output on our test unit was a bit below the 1 watt rating but there was still plenty to work the local gang with good antennas. We had to reduce the power even further to prevent driving an external Mirage D24 amplifier into nonlinearity.

The instruction manual is well written and complete. It provides a block diagram as well as a full schematic with a parts placement diagram. There is no alignment information, but most ATVers lack the test equipment to properly adjust the extensive filtering in a VSB transmitter anyway.

Customer service is excellent. Mike Lamb and Al Chandler at AEA really believe in their creation and are very helpful answering questions and listening to users' comments.

As a matter of illustration, we reported a problem with sync distortion early in this review. After several conversations, Al Chandler concluded that there was indeed a small design flaw in the new 430A model. This problem was fixed by the addition of a 47 ohm resistor in parallel to R40 in the modulator circuit. The sync distortion was cured and all further production units will include this change.

We would rather see a modulator circuit where the video is clamped to blanking, the sync regenerated and re-inserted through a sync level pot. This would provide constant sync level with various video sources as well as the ability to fade to black with the front panel video gain pot without lossing synclock.

There have been some negative comments concerning the unit's relatively high price tag. After looking at the quality and cost of the parts used, as well as the obvious amount of research and design time, it is easy to conclude that the profit margin on this rig is probably a lot less than the competition's offerings. It is simply not cheap to produce a quality, vestigial sideband TV transmitter.

If you want an ATV signal second to none and as close as possible to "real" TV, you could not go wrong with the AEA FSTV-430A. While not perfect, as far as we are concerned it is the new standard of ATV performance.

Using the FSTV-430A with External Power Amplifiers

The one watt power output from the FSTV-430A (as well as the other low power rigs on the market) is plenty to work the local gang on simplex or any nearby ATV repeaters. Most hams, though, will sooner or later want to hook up an external power amp to get some extra range. As with any amplitude-modulated mode, linearity is critical, especially with vestigial sideband ATV. You can't just hook up an amp and adjust for maximum power on the wattmeter.

Most amplifiers available to amateurs are not truly linear, particularly near their power rating. To achieve any resemblance of linearity we must be prepared to de-rate that expensive new "50 watt" amplifier to around 20 watts or so average power, as seen on a wattmeter. Of course, video being the complex waveform that it is, peak power is considerably higher. This is even more important when we are trying to run vestigial sideband. Nonlinearity produces distortion that can "regenerate" that lower sideband we have been so careful to attenuate. As a matter of fact, the competition's argument against VSB on amateur television is that even though you can generate it, you can't amplify it with amateur grade equipment. We agree with that argument to some degree, but believe that the merits of VSB still make it a very worthwhile goal.

Figure 3 shows the results of running the FSTV-430A through a Mirage D24 50 watt amplifier modified for ATV by P.C. Electronics. The drive from the transceiver has been reduced approximately 3 dB to keep from overdriving the amp.

Average power output as read on a Bird meter is 18 watts, with just-noticeable sync compression. Comparing this sweep with that shown in Figure 2 we see that the nonlinearity has caused the lower sideband aural subcarrier to go from being 36 dB down from its upper sideband counterpart to being only 14 dB down (−52dBc to −30 dBc). However, lower sideband video response is still approximately 16 dB below the upper sideband response. This is not too shabby, as the FCC defines vestigial sideband for broadcast television as being only 20 dB down.

Figure 4 shows the sweep obtained by using a home-brew 30 watt amplifier with a Mitsubishi 57745 "brick" sold by R.F. Parts, Inc. The drive from the FSTV-430A had to be reduced approximately 6 dB, as the amplifier has very low input power requirements. The lower sound subcarrier is down from the upper by 15 dB and the lower video response is down 15 dB (−31 dBc) or better. Average power output was 20 watts with NO SYNC COMPRESSION. Not bad for an $89 amplifier chip!

AEA has a 50 watt tower-mounted amplifier in the works that should be available by the time you read this. It is designed from the ground up for extremely conservative and linear operation to better preserve the vestigial response characteristics of the FSTV-430A. Included will be an integral GaAsFET preamp as well as a "through-the-coax" power feed system. It should prove very interesting. ■

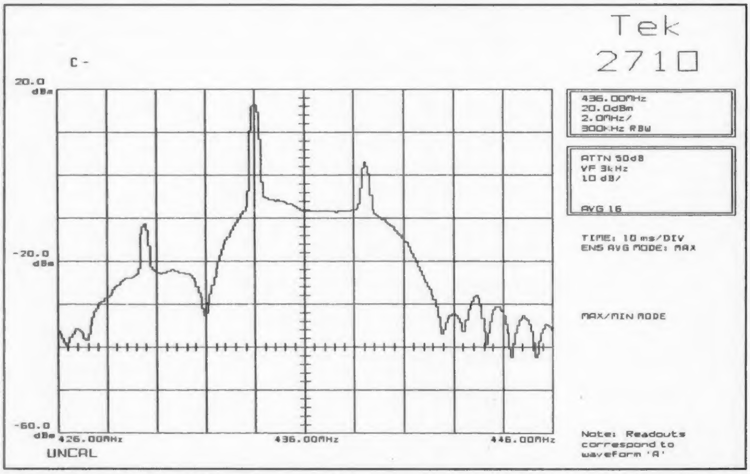

Figure 5. Output sweep of home-brew amplifier using a Mitsubishi 57745. Not bad for an $89 chip!

Food for thought.

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77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
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High Altitude Ballooning

New Heights for ATV!

by Bill Brown WB8ELK

August 15, 1987. . . The first attempt to send ATV to new heights via a weather balloon! Winds gusting to over 20 knots cause the fragile package to crash repeatedly into the ground (Photo A). The third attempt just barely clears the nearby cornfield, and the rather beat-up payload rises upwards at nearly 1000 feet/minute to achieve record altitudes. Since that flight, 13 flights have occurred in various locations all over the US.

Why send up a balloon? Let's take a look at the big advantages of increasing your antenna height. Those of you active on the VHF and UHF bands know that getting your antenna up as high as possible makes all the difference. Just getting your antenna above the treetops can really improve your signal tremendously. Although low-noise preamps, high power amplifiers, large antenna arrays and band enhancements can extend your range substantially, the average VHF or UHF station can expect line-of-sight coverage. This is particularly true of a wide bandwidth ATV signal. Depending on terrain, the average ATV station's range with a 50-foot tower is between 30–50 miles for a watchable picture.

What effect will increasing your antenna height have on coverage? Line-of-sight range can be determined with the formula: Radio line-of-sight = $1.41 \times \sqrt{H}$ where H = height in feet; and optical line-of-sight = $1.22 \times \sqrt{H}$. Figure 1 shows the dramatic increase in range that results from increased antenna height.

Just by taking your rig up in a small airplane you can expect 122 mile or more contacts at 10,000 feet. A weather balloon will allow you to increase your antenna height to over 100,000 feet! Using a 1 watt ATV transmitter to an omni-directional antenna, you can send a watchable picture up to 400 miles away. Experimental results indicate that 2 meter reception seems to follow the radio line-of-sight formula, while ATV reception follows the optical line-of-sight formula (Figure 2).

Although the payload on the first flight stopped transmitting at 60,000 feet due to battery failure, stations 300 miles away were able to watch the ATV signal, and the 50 milliwatt, 2 meter signal was heard out to a distance of 400 miles. Subsequent flights have operated for the complete duration and confirmed the theoretical range limits. The highest altitude achieved so far was over 133,000 feet from a balloon launched from the Neil Armstrong Air & Space Museum (Wapakoneta, Ohio) last summer. Signals from that flight were received over a 10-state area from Pennsylvania to Iowa.

Line of Sight Range

Optical = $122 \times \sqrt{H}$

Radio = $1.41 \times \sqrt{H}$

Antenna Height*	2 Meter Range	ATV Range
50′	9 miles	8 miles
10,000′	141 miles	122 miles
50,000′	315 miles	273 miles
100,000′	445 miles	388 miles

*Height in feet

Figure 1. Line-of-sight range vs. altitude.

Photo A. First flight of the ATV package.

Photo B. Inflating the balloon.

Launch Your Own Balloon

A balloon flight is a great way to demonstrate the capabilities of amateur radio to a wide audience. Just inflate a 5-foot weather balloon in a park or public area and watch how quickly the crowd forms (Photo B)! Launch preparations and flight coverage can spark the interest of your whole radio club. Payload design and assembly, HF net launch coverage, receive station design and, of course, tracking down the payload, offer something for everyone.

Radiosonde Flights

Not wishing to reinvent the wheel, I decided to see how the weather bureau obtained their upper air winds aloft forecasts. It turns out that 5-foot weather balloons are launched twice daily at 0000 and 1200 UTC from over 73 sites across the US (Figure 3). After visiting two sites (Vandalia, Ohio, and San Diego, California) I learned firsthand the tricks of the balloon-launching trade. The upper air sounding balloons carry a payload known as a radiosonde (or rawinsonde—Radio Wind Sonde). A 5-foot balloon filled with helium (or hydrogen at some launch sites) carries the 1.5-pound radiosonde up to around 100,000 feet or so.

The radiosonde transmits a wideband telemetry signal on or about 1680 MHz which is received by an 8-foot tracking dish. The dish can measure azimuth and elevation to an accuracy of 0.01 degree. A tone sequence is sent out from the sonde indicating pressure (altitude), temperature and humidity. The altitude telemetry and tracking antenna position are used to calculate the wind speed at various flight levels. This data is sent to the National Weather Service for use in weather and winds aloft forecasting.

If you own an ICOM R-7000 or other rig which can tune to 1680 MHz (± a few MHz) in wideband FM mode, you can listen in on the sondes. Using a 2-foot dish I've been able to pinpoint the location of several flights from Vandenberg AFB in California and actually see the balloon burst at 100,000 feet. Through a pair of binoculars it was quite an impressive explosion!

Reiner Junge DC3OQ/W5 and Mike Olbrisch KD9KC have even been chasing down the sondes launched from the El Paso, Texas,

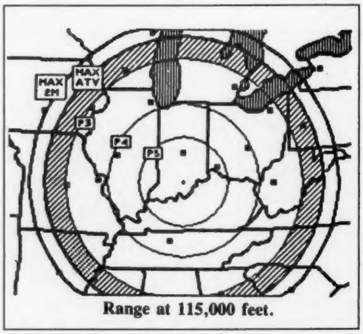


Figure 2. Line-of-sight coverage map for 115,000 feet.

site. They use an ICOM R-7000 and a homebrew, 11-element beam to track down the radiosonde as it parachutes back to earth. They've recovered over 40 of them over the past few years and they eventually want to actually catch one before it hits the ground. On their last chase the sonde landed just 50 feet in front of their jeep!

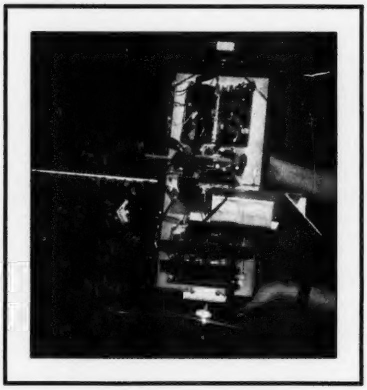


Photo C. Live camera payload.

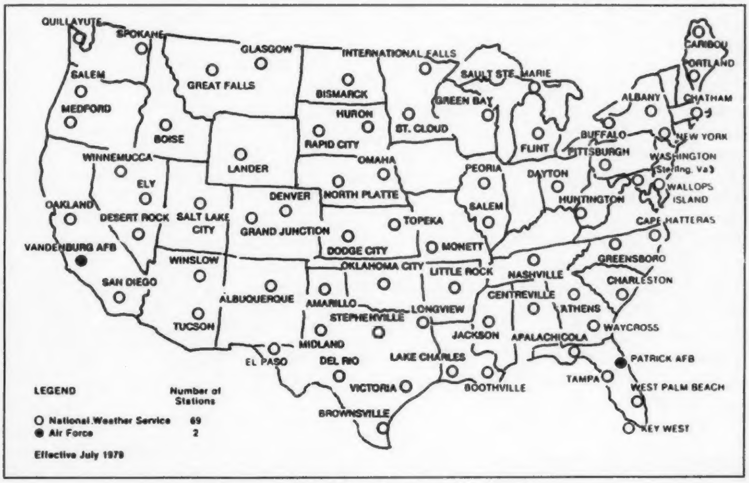
Photo D. Jeff Brown KA8WLV readies the camera payload for liftoff.

The Payload

FAA regulations set a payload limit of 4 pounds on a free-flight balloon. Although 6 pounds can be used if certain density requirements are met, it's best not to get caught up in any paperwork or permit requests. Always alert the FAA whenever you plan a flight. Give them a week or two to issue a NOTAM (Notice to Airmen). You should contact them the night before the flight, six hours before liftoff, and get clearance for takeoff 30 minutes before final countdown. Above 60,000 feet is uncontrolled airspace, but they like to know when the payload is descending back down below this altitude. If you have a chase plane, they can handle this communication readily with the nearest control center.

It's quite a challenge to design a self-contained payload complete with battery pack that weighs under 4 pounds (Figure 4). Fortunately, the lithium cell has made extremely powerful and lightweight battery packs a reality. SAFT makes a D-Cell (the LX3457) that is a real powerhouse of energy. Five of these cells provides you with a 13.8 volt pack with a 7 Ah capacity weighing under 1 pound! You can also use 10 C-cells (SAFT LX2649) as long as you install blocking diodes in each chain. If your current drain is under 1 amp, you can power your package for upwards of 7 hours with this pack. WARNING: Be very careful when assembling lithium cell packs. Due to the high current capabilities, a lithium cell may explode if shorted out. The newer cells have a safety vent, but it pays to have a healthy respect when handling them. If you're wary of assembling your own battery pack, AVEX Portable Battery can put together a complete pack with a safety fuse for a reasonable fee.

Try to keep everything as light as possible. I use a small piece of double-sided circuit board and mount components on both sides. If shielding is required, use lightweight copper foil or double-sided PC board stock. Antennas can be made out of lightweight aluminum or brass rod with as few connectors as possible. I mount everything in a 1.5 inch thick styrofoam shell and seal it up with duct tape. Not only is the styrofoam lightweight, it also protects the electronics from the bone-


QUILLAYUTE
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GLASGOW
INTERNATIONAL FALLS
CARIBOU
PORTLAND
SALEM
GREAT FALLS
BISMARCK
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GREEN BAY
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OAKLAND
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SALEM
TOPEKA
CAPE HATTERAS
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NASHVILLE
CHARLESTON
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CENTREVILLE
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LONGVIEW
TUCSON
JACKSON
APALACHICOLA
WAYCROSS
MIDLAND
EL PASO
DEL RIO
LAKE CHARLES
PATRICK AFB
TAMPA
VICTORIA
BOOTHVILLE
WEST PALM BEACH
BROWNSVILLE
KEY WEST
LEGEND
Number of Stations
○ National Weather Service 69
● Air Force 2
Effective July 1979

Figure 3. U.S. Radiosonde launching sites.

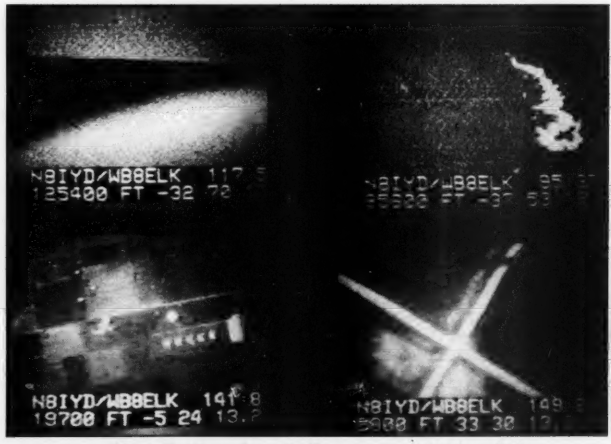

N8IYD/WB8ELK 117.5
125400 FT -32 70
N8IYD/WB8ELK
N8IYD/WB8ELK 141.8
19700 FT -5 24 13.
N8IYD/WB8ELK 149
5000 FT 33 30

Photo E. Views from the live camera video downlink.

Photo F. Launch crew in position.

Photo G. One of the chase vehicles ready to track down the package. Photo by Phil KA9WGN.

Photo H. A jubilant chase team recovers the prize from the cornfield!

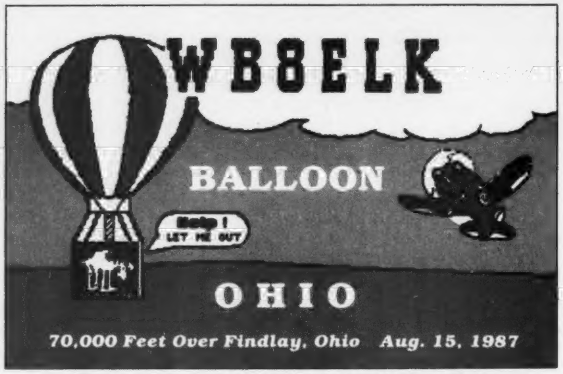

WB8ELK
BALLOON
Help! LET ME OUT
OHIO
70,000 Feet Over Findlay, Ohio Aug. 15, 1987

Photo K. Commemorative QSL for first balloon flight.

chilling cold temperatures at the higher altitudes. While it may be 100 degrees at ground level, temperatures plummet to 60 below at 50,000 feet. Once through the coldest part of the atmosphere (between 35,000–70,000 feet), it warms up to a "toasty" −23 degrees at 110,000 feet.

What to fly? Payloads have consisted of a 10-milliwatt 2-meter CW transmitter, packet digipeater (the world's highest and BUSIEST digi), digitized voice messages on 2 meters, linear transponders and many different ATV configurations. The most recent live TV camera flights used a flight computer to superimpose altitude, temperature and battery voltage directly over the camera's view of the Earth below (Photos C and D). *[Ed Note: See the article on rocket ATV in this issue].* Bob N8IYD even built a servo-mounted mirror to look at the Earth as well as at the horizon. At 100,000 feet, the view was very similar to what you'd expect from the shuttle (Photo E). The blackness of space and the curvature of the Earth could clearly be seen.

Giving Your Payload a Ride

The typical balloon flight system is shown in Figure 5. Most of the balloons flown so far have been manufactured by Kaysam Corp. of Paterson, New Jersey. Although I haven't tried them yet, high quality balloons made by Toetex are also available from both VIZ Corp. and Vaisala, Inc. (see the sidebar for a list of sources). These balloons are specifically designed for high altitude flights, and their burst altitudes can be accurately predicted. As the balloon rises in altitude, the atmospheric pressure decreases. At 100,000 feet the pressure is only 1% that of sea level. Even though the neoprene weather balloon may start out with a 5-foot diameter on the ground, it expands as it encounters lower atmospheric pressures. At 100,000 feet your balloon will be nearly 27 feet in diameter as it approaches a near vaccuum at the edge of space. At this point it bursts like a giant party balloon, allowing your payload to parachute back to Earth.

The three balloons used successfully in past flights are the Kaysam models 90G, 105G and 50P. The 90G will lift a 4-pound payload to around 90,000 feet, while the 105G can attain heights approaching 120,000 feet. For small payloads under 2 pounds, the 50P can take your payload up to about 60,000 feet at a fraction of the cost of the bigger balloons (and a substantial savings in helium!).

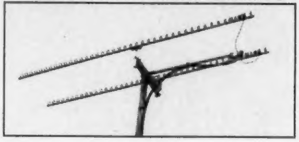
Inflating the Balloon

It takes about 120 cubic feet of helium to fill a 5-foot weather balloon (Kaysam 90G) to lift 6 pounds. I typically fill the balloon to have 50% more lift than payload (6 pounds lift for a 4-pound payload) to achieve a good takeoff and rise rate (about 1000 feet/minute). Although you can take off with as little as 2 ounces of positive lift, you run the risk of crashing the payload on takeoff and prolonging the flight. A quicker flight generally lands a little closer to home and avoids your having to chase it hundreds of miles across the country. It's a good idea to buy a tank of helium with twice the amount that you need, just in case of disaster. Always keep a spare balloon around for the same reason. You can use the excess helium to fill up party balloons with notes attached for the kids. Some of these party balloons have been found over 400 miles away. And, of course, you'll find plenty

Photo I. Debbie Fligor KA9JYI ready to launch the Microballoon.

Photo J. Massive 500-foot balloon prepares for liftoff from Balloon Facility. Photo courtesy of National Scientific Balloon Facility, Palestine, Texas.

MICROWAVE ANTENNAS



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1844LY	44el	loop Yagi (assem.)	1691 MHz	21 dBi	$99.00
2355LYK	55el	Superlooper Kit	1296 MHz	22 dBi	$99.00
1345 LYK	45el	loop Yagi Kit	2304 MHz	21 dBi	$75.00
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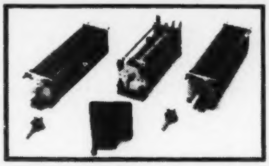

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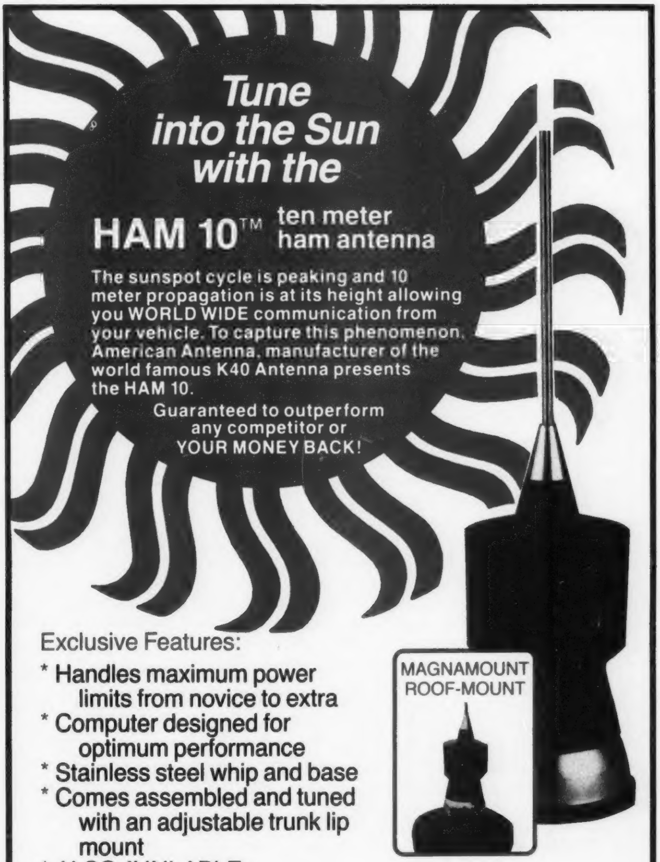

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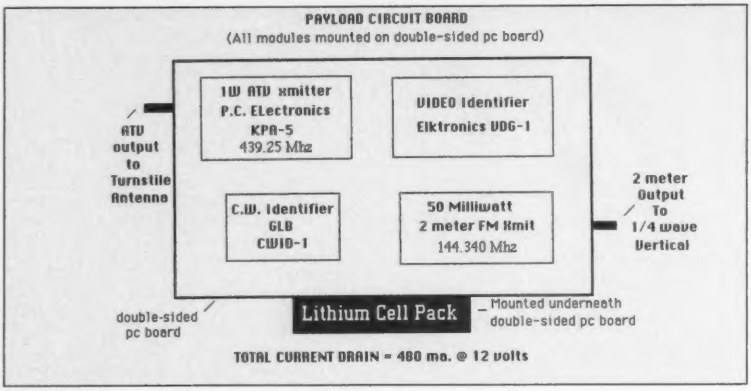
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VIDEO Identifier
Elktronics VDG-1
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C.W. Identifier
GLB
CWID-1
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2 meter FM Xmit
144.340 Mhz
2 meter Output To 1/4 wave Vertical
double-sided pc board
Lithium Cell Pack
Mounted underneath double-sided pc board
TOTAL CURRENT DRAIN = 480 ma. @ 12 volts

Figure 4. Payload block diagram (first flight).

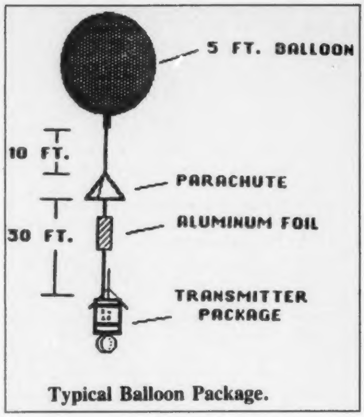
5 FT. BALLOON
10 FT.
PARACHUTE
30 FT.
ALUMINUM FOIL
TRANSMITTER PACKAGE
Typical Balloon Package.

Figure 5. Balloon flight system.

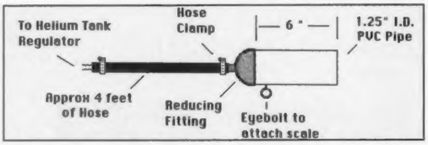
To Helium Tank Regulator
Hose Clamp
6"
1.25" I.D. PVC Pipe
Approx 4 feet of Hose
Reducing Fitting
Eyebolt to attach scale

Figure 6. Helium filling apparatus.

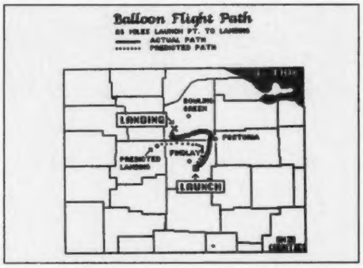
Balloon Flight Path
ACTUAL PATH
PREDICTED PATH
LANDING
BOWLING GREEN
FOSTORIA
PREDICTED LANDING
FINDLAY
LAUNCH

Figure 7. Predicted vs. actual flight path.

of folks willing to use up your excess helium to imitate Mickey Mouse.

For the larger balloons, it's a good idea to find an enclosed barn or hangar for inflation. Any wind quickly turns the inflation process into a very harrowing experience. Make sure the building's door is large enough to remove the balloon. It only takes one sharp object to cause a very expensive POP!

The uninflated balloon can be laid out on a smooth table or surface. I use a large bedsheet to cover the table surface. Joe WB8MSJ designed a special filling apparatus to make inflation easy. See Figure 6 for construction details. The end of the filler hose is constructed out of 1.25" I.D. PVC pipe (this gives you a 1.5" O.D. filling nozzle) which allows the balloon nozzle to fit snugly over the filling tube. The balloon is held in place with a spring clamp or a hose clamp. The filler nozzle goes through a reducing adaptor to a regular automotive hose which connects to your helium tank regulator. If you have a party balloon regulator, remove its small rubber nozzle and replace it with your filling hose. ALWAYS USE A REGULATOR unless you want a jet-assisted balloon launch!!

An eyebolt can be mounted in the part of the filler nozzle away from the balloon (be sure to epoxy around the eyebolt to prevent leaks). This allows you to hook in a digital fishing scale or known weight. Taking into consideration the weight of your filling apparatus, you can easily measure the balloon lift until you reach the desired value.

After inflation, tie the balloon nozzle closed just above the filling tube. Use at least three good knots, then loosen the hose clamp and carefully slide the balloon off of the filling tube. I usually wrap the end of the balloon nozzle with a little furnace tape just to be sure. Run about 15-20 feet of line down to the top of your parachute and tie securely. The parachute should be at least 3 feet in diameter (4 or more feet is best) and should have a plastic ring below the chute to keep the shroud lines from tangling. Attach another line to the bottom of the shroud lines and run about thirty or more feet down to the payload.

U.S. Balloon Launches Since 1987

WB8ELK 8/15/87—Findlay, Ohio. P.C. Electronics 1 watt ATV transmitter with Elktronics video ID. 50 mW, 2m FM with GLB CW ID. Maximum altitude of 60,000 feet. Found six weeks later in soybean field 26 miles away.

W9PRD 6/4/88—Greensburg, Indiana. Wyman Research 1.5 watt ATV transmitter and 400 mW Johnson 2m FM. 119,000 feet maximum altitude. Found in tree 86 miles southwest of launch site.

W9PRD 10/8/88—Greensburg, Indiana. Wyman Research 1.5 watt ATV transmitter and 400 mW Johnson 2m FM. 110,000 feet. Found in front yard of house near Rabbit Hatch, Kentucky, after travelling 55 miles.

KA8TEF/WB8ELK 10/23/88—Findlay, Ohio. Pac-Comm micro TNC and ICOM 2A HT. Packet digipeater. Packet connections made over an 8-state area. 85,000 feet altitude. Package lost on island in middle of Lake Erie.

WB8ELK 1/21/89—Hesperia, California. First flight of a live camera to 100,000 feet using ATV. 1 watt PC ATV transmitter. Sony HVM-302 B/W camera. 100 mW VHF Engineering, 2m FM. Seen in Phoenix, Arizona, over 350 miles away. Found by Tom W6ORG in his helicopter on the desert floor 22 miles northwest of launch.

N4HBO/WA4ADG 4/15/89—Knoxville, Tennessee. 10 milliwatt 2m CW transmitter launched with 60 party balloons from children's musuem. Beacon heard for 2½ hours as far away as 150 miles.

KV5G/WB5UXF 4/29/89—Pearland, Texas. 10 watt ATV system with live camera. Maximum altitude of 12,000 feet. Seen over 150 miles away in Austin, Texas. Farmer shot package thinking it was bomb. One of the bullets broke the camera's vidicon tube.

N8IYD/WB8ELK—7/23/89 Neil Armstrong Air & Space Museum, Wapakoneta, Ohio. Live TV Camera (Sony HVM-302) with on-screen telemetry from flight computer commemorating first moonwalk. 1 watt Kreepie-Peepie ATV transmitter (P.C. Electronics) and 50 mW, 2m FM with CW ID. Maximum altitude of 133,000 feet. 400-mile range on ATV and 2m.

WA4ADG/N4HBO—8/5/89 Oak Ridge, Tennessee. Special digitized voice message commemorating man's first moonwalk. Voice on 2 meter FM along with ASCII telemetry, CW telemetry from onboard flight computer on 10 meters. ELT test transmitter for Civil Air Patrol exercise. 90,000 feet altitude. Found in tree in suburb of Knoxville by the CAP, taking several hours to remove.

KA9SZX/KA9SZY/WB8ELK/N8IYD—10/7/89 Champaign, Illinois. Third flight of the live camera payload. Servo-operated mirror added to provide views of the horizon as well as the ground. Spectacular views of the curve of the earth and blackness of space above 100,000 feet. Maximum altitude of 125,000. Found in soybean field in Indiana after travelling 113 miles.

KA9JYI/KA9SZX/KA9SZY/WB8ELK (Photo I)—10/28/89 Champaign, Illinois. Micro-balloon flight using leftover helium from 10/7 flight. 10 milliwatt CW transmitter (See "Two Meter Tracking Transmitter," *73*, July, 1990) on 2 meters with temperature telemetry. Launched with small 3-foot sounding balloon to 60,000 feet. Found in field 86 miles away, near Remington, Indiana, by Eb WD9I.

KD0FW—2/10/90 Lawrence, Kansas. 3 watt ATV transmitter with VDG-1 video display. 50 mW, 2-meter transmitter with digitized voice message. Maximum altitude of 94,000 feet. A nearly snow-free color picture received over 390 miles away to the Colorado border. Found in tree 56 miles east of launch site near Peculiar, Missouri. Sawed down part of tree and shot at string with shotgun to bring it down.

WA4ADG—5/19/90 Knoxville, Tennessee. 10 meter in—2 meter out linear transponder. Altitude of 90,000 feet. Operating much like an OSCAR satellite, stations as far away as Ohio were able to work through the transponder. Lost in very rugged and mountainous terrain near the Appalachian Trail, 77 miles east of launch site.

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FL-53A 250 Hz CW filter (2nd IF)....	115.00	**109^{95}**
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RC-10 External frequency controller	49.00	

IC-735 HF xcvr/SW rcvr/mic *(Special)*	1149.00	**969^{95}**
PS-55 External power supply	219.00	**199^{95}**
AT-150 Automatic antenna tuner	445.00	**389^{95}**
FL-32A 500 Hz CW filter..............	69.00	
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UT-30 Tone encoder	18.50	
IC-725 HF xcvr/SW rcvr....... *(Special)*	949.00	**799^{95}**
AH-3 Automatic ant tuner .. *(Special)*	489.00	**379^{95}**
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AT-500 500W 9-band auto. ant. tuner ...	589.00	**519^{95}**
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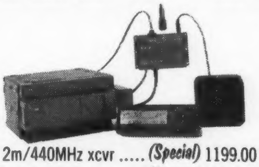

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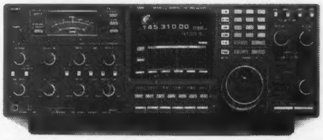

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A 6-foot strip of aluminum foil is taped to the line just below the parachute to aid in tracking by FAA radar. A suitable parachute is available from VIZ Corp.

Launch!

Apply power to your payload (I almost forgot this step on two separate launches!). Just as you remove the balloon from its shelter, Mother Nature will probably decide to give you a hard time. It's typical to have a dead calm condition for hours before the flight, then be hit with 20-knot wind gusts at launch. Just hang onto the balloon for dear life and try to keep it from hitting the ground. Have your ground crew hold the payload DIRECTLY downwind and let go of the balloon (Photo F). Release the payload when the balloon is overhead and hope you see it again!

HF Net

Now the fun begins. During the past flights we've used either 7.155 or 7.232 MHz for our launch information net. Even if you don't receive any signals from the balloon package, it's great fun just to listen in to one of these nets. The excitement builds as the words "The balloon is UP!" comes over the loudspeaker. It's quite a thrill to listen to the reception reports coming in from increasingly further distances as the balloon gains altitude. Some of our net controls definitely have my vote for NASA mission controller!

Tracking it Down

Keeping track of a fast moving balloon package has to be the "Ultimate Foxhunt." If you ever expect to see your payload again, try to organize a chase team with DF gear (Photos G and H). If there is a local foxhunting or T-hunting group, you should have no trouble getting volunteers for the chase crew. It's relatively easy to track the balloon when it's in the air. The tricky part comes when it finally lands. It could land anywhere—in a tree, a ravine, or draped across someone's front yard. Pick a 2 meter coordination frequency and have the chase vehicles provide periodic antenna headings to help track the balloon's position. This will narrow down the search area once the package lands.

A chase plane (or helicopter) is invaluable in pinpointing the final touchdown point. Even if no DF gear is on board the plane, the payload's position can be narrowed down close enough to enable the ground team to start hearing the beacons.

The Indianapolis Foxhunters are quite experienced at bringing back payloads alive. They have four successful recoveries to their credit. Hacking their way through dense woods, mosquito-ridden cornfields, and the hills of Kentucky, usually nets them their quarry. Paul W9DUU and Larry WB9YAJ are such avid balloon hunters they they will usually track any balloon launched within 500 miles of Indianapolis.

Another experienced group is the Southern California T-hunters. In my first live TV camera flight from the Mojave desert, they assembled a massive effort to keep track of the balloon's path. Aiding in the hunt were members of the Amateur Television Network (ATN). The ATV group supplied not only a chase plane, but a chase helicopter! The T-hunters were so accurate in their headings that the chase plane was able to see their wing in the downlinked video and catch a glimpse of the package whizzing past them. It only took a few minutes for Tom W6ORG to fly his helicopter right to the impact spot in the Mojave Desert.

It's always great to get your package back after a flight to the edge of space. It's also good for a few weeks of incredible stories on the local repeater!

Predicting the Landing Site

I've developed a BASIC tracking program for the IBM or compatible PCs that will predict where your package will land with a fair degree of accuracy (Figure 7). For best results you need to find a way to obtain the latest radiosonde wind soundings from a nearby site. This is not an easy task; however, your local weather bureau may be able to tap into this information. Using data from nearby radiosonde flights, I've been able to predict the landing point of our payloads within a couple of miles in several instances. The Wapakoneta flight prediction missed by only 0.9 of a mile.

Reasonable results can be obtained through use of the aviation winds aloft forecast. This data is only good up to 53,000 feet in selected areas, but it should provide you with information on the general area where your package will land. If you are a pilot, you can obtain this information via the DUATS direct dial-up modem service or from any Flight Service Station. Those of you on CompuServe can access this information as well; type GO AWX-1 to go to the aviation weather section. Select option 4 to obtain winds aloft for your area. This wind data is compressed by the weather service and needs to be decoded. The first part of the data is wind direction (add a zero to the first two digits). This is followed by two digits representing wind speed. The last two digits indicate outside temperature. Example: 312349 translates to a wind direction of 310 degrees, wind speed of 23 knots and a temperature of −49 degrees C.

I will provide this tracking program on the *73 Magazine* phone line BBS, or you can send me a blank disk and return postage. The program name is BALLTRAK. Also look for the program called BALLIFT. BALLIFT calculates the lift capabilities of various Kaysam and Totex balloons along with predicted maximum altitudes.

Since many of the balloon manufacturers have a minimum order, I can provide small quantities of balloons and parachutes. Also I can provide a videotape suitable for club presentations, which summarizes most of the balloon flights, for $15 + $3 postage.

> ***"My eventual goal is to send a balloon around the world!"***

The Future

Plans are afoot for a crossband audio repeater, an ATV repeater, more live TV camera flights, and a dual-balloon packet linking experiment. These experiments will allow stations up to 800 miles apart to communicate via the balloon. Also, experiments will be flown attempting to control the return of the payload, either through a pressure release valve or a radio-controlled glider.

Sometime in 1991, an opportunity may present itself to fly a payload with a NASA research balloon from the National Balloon Scientific Facility in Palestine, Texas. The Balloon Facility sends up giant 500-foot diameter balloons carrying massive payloads of 3000 pounds or more (Photo J). Many of their balloons are made by Winzen Research in Sulphur Springs, Texas. They take nearly 160,000 cubic feet of helium to inflate. They can almost track the balloon's progress by the many UFO reports that come streaming in during the flight. My tiny payload will be hardly noticeable compared to these weights. These flights typically reach upwards of 140,000 feet and may stay at this altitude for some time. I'll fly a color camera on this flight since their retrieval success rate is almost guaranteed!

Also, I'll be attempting a few cross-country flights using a plastic zero-pressure balloon. A zero-pressure balloon vents excess helium at float altitude and does not burst. However, ballast needs to be released at night to stay aloft. My eventual goal is to send a balloon around the world!

Next month we'll examine some telemetry and payload electronics in detail. 73

You may contact Bill Brown WB8ELK at 73 Magazine, *Forest Road, Hancock, NH 03449.*

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73 Review

by Joe Moell K0OV

1250 MHz ATV Downconverter and Antenna

Tuning in ATV repeaters the fun and easy way.

PC Electronics
2522 Paxson Lane
Arcadia CA 91006-8537
Tel. (818) 447-4565
Price Class: TVC-12G
Downconverter, $109
20624 Tonna Antenna, $70

Down East Microwave
Box 2310, RR 1
Troy ME 04987
Tel. (207) 948-3741
23LNA-WP Preamplifier, $100

Amateur fast-scan television (FSTV) is mushrooming. It seems like every ham with a video camera wants to get on and show off his cinematography skills. The availability of space shuttle video via satellite, and the recent ATV balloon flights by WB8ELK, have helped fuel the aerial television (ATV) excitement.

Several years ago I dabbled in ATV, mostly simplex on the 70cm band. That meant limited range for those of us who don't have the good fortune to live on a hilltop. Still, it was fun exchanging pictures with WA6IGY and the other locals. Since then, ATV groups nationwide have begun installing repeaters on various hilltops and mountains, giving everyone an opportunity to join the fun of longer range, high quality ATV.

Crossband repeater systems make it possible to operate duplex so you can see your pictures as others see them. Inputs are common ATV simplex frequencies such as 426.25, 434.0, and 439.25 MHz. Outputs are on coordinated frequencies in the 902–928 and 1240–1300 MHz bands.

My interest was rekindled when some of the local transmitter hunters began to shoot videos of their T-hunt escapades for "show and tell" on ATV repeaters in the Los Angeles area. Most of these repeaters have outputs on the 23cm band, so a new receiving setup was in order.

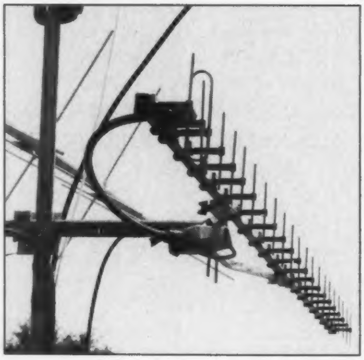

Photo A. The Tonna 23cm yagi, side-mounted with a home-brewed right angle adapter plate.

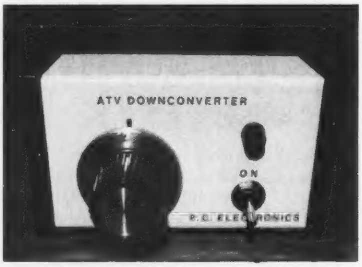

Photo B. The TVC-12G is built into a customized Ten-Tec box.

I like to build ham equipment, but I was intimidated by the thought of taking on a microwave project with limited test equipment. I'd rather spend the time making T-hunt gear. But good news! PC Electronics of Arcadia, California, had everything I needed. The simplest setup is the TVC-12G downconverter and the Tonna 20624 23-element yagi antenna. Two days after I phoned, the packages arrived.

ATV for the '90s

Tom O'Hara W6ORG of PC Electronics has been "Mr. ATV" in Southern California for many years. In that time, ATV rigs have progressed from crude conversions of bulky tube-type surplus gear (how many Motorola T44s have been put on ATV?) to little boxes full of GaAsFETs and other state-of-the-art goodies. The new downconverters make it easy to get into microwave ATV and get good color reception.

There are several pitfalls to getting good ATV pictures on the 23cm band. It's not like pulling up the rabbit ears to watch *Eye on Podunk* on Channel 7. There are two ATV repeaters viewable on 23 cm in the Los Angeles area: Mt. Wilson on 1241.25 MHz and Santiago Peak on 1253.25 MHz. There are some hills in the way so I can't see Mt. Wilson. My local repeater is on Santiago Peak at 5670 feet, but it runs only 25 watts of transmitter power into a 10 dB gain antenna. Compared to over 300 kilowatts ERP for TV Channel 7—let's see—that's 30.8 dB difference. The path loss attenuation increases with frequency, so there is 17.1 dB more path loss at 1253.25 MHz than there is for Channel 7.

You would think that getting good video under these circumstances would be impossible. Fortunately, we can make up much of that loss by using a high antenna gain (16.3 dBd). We also use a low-noise figure converter with a GaAsFET transistor in the front end. If that's still not good enough, you can add a GaAsFET preamp right at the antenna to eliminate system noise figure degradation by the coax downlead.

The 20624 antenna kit, part of the F9FT line, is a product of Tonna in France. The reflector and 21 directors are #12 AWG stiff rod, held in place 1-¾ inches away from the ⅝-inch, inch square boom by plastic spacers. You have to drive each element through its spacer and carefully center it, then snap it onto the boom. The fit is positive and tight, ensuring that all elements are at optimum spacing and won't loosen up.

Tonna has factory-connected the driven element to a short length of RG-213 coax, so all you have to do is snap it in and attach the high quality N fitting Tonna supplies. The tricky connection of coax to driven element has already been made and sealed in place.

The 20624 F9FT Antenna

Be careful when buying or ordering your F9FT antenna. Tonna makes two 23-element yagis for 23cm. The 20623 is intended for weak signal work above 1280 MHz, while the 20624 covers 1240–1280 MHz for ATV and OSCAR. The PC Electronics catalog sheets incorrectly list the 20623 antenna for ATV, but the company is actually shipping the correct 20624 model. *[Ed. Note: Present P.C. catalog shows correct number.]* If you order the anten-

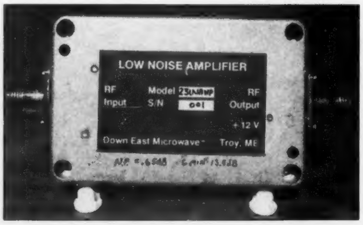

Photo C. The Down East Microwave preamp is a big help in microwave fringe areas.

na from another dealer, be sure you specify the 20624 for ATV.

The supporting mast must not pass through the plane of the elements.

This means that the antenna should be atop the mast for horizontal polarization. ATV repeater antennas are usually vertically polarized, so drill an extra pair of holes in the support bracket for side mounting, or use a homemade right angle adapter plate and short piece of pipe to side mount it as I did (see Photo A).

The 3 dB beamwidth of the 20624 is less than 10 degrees. This makes aiming a bit tricky. I suggest using a rotor with precision control instead of a TV click-click type. Forward gain is within one dB of spec from 1205–1271 MHz, but good transmitting SWR (1.25 or better) is limited to the 1250 to 1270 MHz range.

At six feet, the boom length of the 20624 is long enough for good gain, but short enough for easy mounting. It could be used portable or even mobile. (ATV T-hunts anyone?) If you need even more sensitivity, the Tonna 20650 55-element antenna has 3.4 dB more gain than the 20624. But its 15-¼-foot boom and 6.7 degree beamwidth make it harder to mount and peak up.

[Ed. Note: Dual 20624's stacked one over the other would give almost 3 dB improvement but with the same horizontal beamwidth. Also appropriate loop yagis are available from Down East Microwave.]

The converter draws only 50 milliamperes at 12 volts DC from a small wall supply. I don't understand why PC Electronics chose a 3/32 inch subminiature phone plug instead of a standard 5mm DC power connector. If the phone plug gets pulled part way out, it shorts out the 12 volt supply and could damage it.

Operation of the downconverter couldn't be simpler. Just tune in the repeater. You don't get detente channel tuning on this converter, but you don't need it. There is full tuning range in the 23cm band with the control on the front panel (see Photo B). The frequency control is not calibrated, and frequency is not marked. I found that there is a small amount of frequency drift in the converter, but it is easily handled by the AFC in the TV set or VCR.

Base Station Use

The lack of "detente" tuning, the drift, and the lack of dial calibration are not problems at home. But these attributes make this converter unsuitable for use at a remote site or a repeater. PC Electronics makes a crystal-controlled downconverter (TVCX-12) that's more suited to remote use.

The TVC-12G converter connects directly to the N fitting of the coax from the mast-mounted preamp and antenna. The converter's output is 181 MHz (TV channel 8) or a nearby unused channel in your area. The RG-6 coax from converter to TV set can be quite long without excessive loss at 181 MHz due to the 20 dB gain in the converter. This means that the converter box does not have to sit on top of the TV set, but can be positioned where it improves the system sensitivity.

In my case, I placed the converter box on a shelf above the workbench, right where the coax cable from the antenna comes out of the attic.

Smoke Test Time

The PC Electronics receiving setup works just fine. The antenna pattern is quite sharp. Weather conditions, including the familiar Southern California inversion layer, affect local propagation of UHF signals. That makes picture quality go up and down somewhat throughout the day.

You may notice apparent changes in rotator heading with time, too.

No, the mountain hasn't moved (not yet, anyway, after all this is earthquake country). The path has probably changed slightly.

Initially, my picture was very good, but not perfect, with a bit of color noise. Gee, why doesn't it work better? The answer came on the next smogless day (I had to wait a week). I had put the antenna/converter setup on the most convenient of several existing masts on my roof. My neighbor's tree stood between that mast and the mountain. Another pitfall! A leafy tree is as good as an attenuator at soaking up microwave signals—that's why a microwave oven cooks vegetables so well.

For best results, the antenna needs to "see" the repeater site. But even in the clear, multipath can cause poor picture quality by partially canceling the signal. I had to probe the roof with the antenna, converter, and a portable TV set to find the best "hot spot."

The TVC-12G, which uses a NE253 GaAsFET preamp, has a noise figure of about 1.5 dB. That's reasonable for an inexpensive GaAsFET, but it's not the ultimate state of the art. If your reception is marginal, or if you must have a long coax run to the antenna, consider a low noise preamp, mounted at the antenna.

The model 23LNA-WP GaAsFET preamp from Down East Microwave has a noise figure of about 0.7 dB. You might think that less than 1 dB improvement wouldn't be a big deal, but I made an A/B comparison between the preamp/converter combination and just the converter mounted right at the antenna. This test eliminated any effect of the coax lead-in. The Down East preamp gave a noticeable improvement.

PC Electronics recommends using the preamp if the antenna lead-in is more than fifty feet. (Low-loss Belden 9913 coax is recommended.) It's easy to modify the converter to apply DC power up the coax to the preamp, using W6ORG's directions. With the preamp, you won't be able to transmit up that coax, but that's unimportant when using a crossband repeater system like those in Southern California.

The Tonna antenna and PC Electronics Converter are now doing a fine job in my ATV station. Several other ATVers in the area use the same setup with good results. Right now, WA6PYE is sending a videotape of his last All-day T-hunt adventure, so if you'll excuse me. . . .

Joe Moell K0OV is also 73*'s "Homing In" columnist. You may reach him at PO Box 2508, Fullerton CA 92633.*

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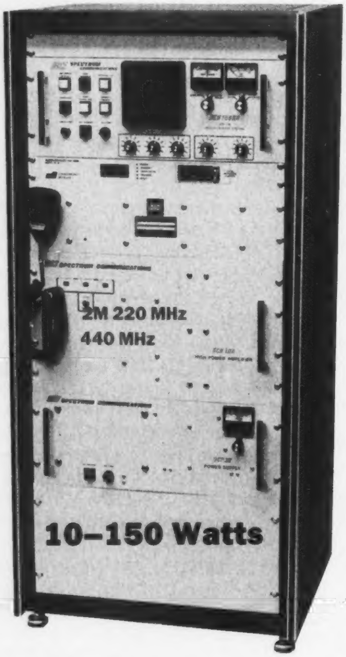

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RTTY LOOP

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Super-RATT, RS Model 4, TNCs

Happy summer, everyone. If the burgers are frying and the soda is chilling, why not sit back and lounge a bit with this month's "RTTY Loop"?

Stewart Emery WA7VOT of Kent, Washington, dropped me a note asking about the availability of Super-RATT, the venerable RTTY program for the Apple II series of computers. Well, Stewart, I asked around a bit, and turned up zilch in the way of a new source. It appears that the program is no longer marketed; or if it is, I can find no evidence of same. With the more potent hardware turning up at every juncture, you might want to take a peek at that sometime. Until then, we'll keep the LED burning for you.

Scott Lieberman, M.D., a radiologist in San Jose, California, is interested in getting onto packet using a Radio Shack Model 4—when he isn't on 20 meter MRI (Magnetic Resonance Imaging), that is! Here is another user of an "orphan computer" looking in vain for that up-to-date terminal program.

Here, at least, we can fare a little better. A few terminal programs for the Model 4 are available, with at least one in the CompuServe HamNet library, I believe. Take a look for it, and again, ask around at a local user's group. Also check TANDYPRO and LSISIG for Tandy Model I/III/4 programs. If you want to run packet with the Model 4, you don't need a specialized packet program.

The TNC units you are looking at only require an ASCII terminal to run them, so about any communications program, such as one you might use to hook into a mainframe or modem, will be quite sufficient. No, they won't have all the bells and whistles, and my Dodge doesn't have a carphone, either, but it still takes me where I want to go!

Put 'em to Use

Speaking of old clunkers, I know I've said this before, but another letter, this one from John C. White WB6BLV struck a responsive chord. WB6BLV, a science teacher at Lindsay High School in Lindsay, California, is the advisor of the school's amateur radio club.

Do you have an old RTTY machine, terminal unit, transmitter, receiver, or just some GFPO equipment lying around in your basement? Why not call a local school, and see if an amateur radio club is around to act as a grateful recipient? Those young'uns will put your trash to use, learn in the process, and we all will benefit. 'Nuff said? Oh, well, if you insist. "GFPO" was the term used so often in the local MARS program during the 1970s, descriptive of the surplus equipment on its way. It means "Good For Parts Only"!

RTTY Cross Display

I have received a few requests from recent RTTYers, who wonder how that famous RTTY cross display was produced. Well, all you need is a terminal unit you can get inside and an oscilloscope, and you, too, can light up your shack with the famous green glow.

The essence of creating the cross display is to feed the horizontal input of an oscilloscope with the output of the space detector of the terminal unit, and the vertical input of the oscilloscope with the output of the mark detector. Now, older terminal units made these signals readilly available to monitor, and even some newer units carry on this tradition. Unfortunately, quite a few demodulators in between allow absolutely no access to these signals without cracking the case.

In that case, you are on your own, owing to the huge number of circuits out there. I will point out, though, that you are looking for the signals after they have been split, either with active or passive filters, and you should couple them through some small capacitors to the oscilloscope's horizontal and vertical inputs. See the figure for a generic version of the kind of hookup I am talking about.

To use this display, tune for equal amplitudes of the two arms of the cross, and your signal is centered within the passband of the demodulator. By tuning a bit more towards the mark, the vertical ellipse will be quite a bit larger than the horizontal. Tune on the space, and watch the situation reverse. Tuning shifts wider or narrower than the optimum becomes easier, as straddle tuning is aided by a visual display of how well the signals are being received. Remember, this is a window on the signals after they have passed the mark and space filters.

One thing to watch for, if you decide to build such a display, is a visual confirmation of the fading that makes diversity reception possible. Very often, you will see the mark or space *only* fade away, from a perfectly tuned signal. This rather narrow fading can knock out communication, without really destroying the signal. Thus, the ability to copy on either the mark or space, lacking true two-antenna diversity capability, remains one of RTTY's strengths.

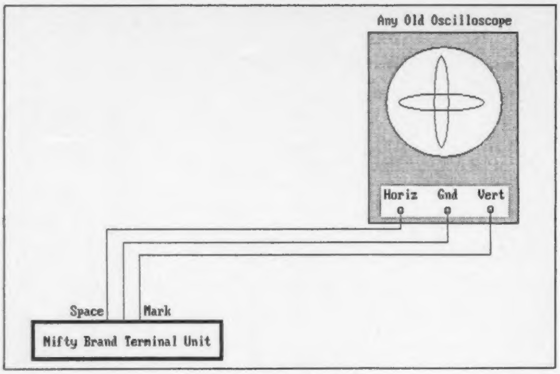

Figure. RTTY Tuning Scope.

One-Chip Projects

I asked about one-chip projects last month, and early returns are gratifying. Many of you have either ideas or questions that clearly apply to others on these modes. I have also been happy to read many of your comments regarding several of the products and services reviewed here in recent months. We have leads out for several more new and interesting items in the world of RTTY, digital communication, and computers, and are always interested in hearing your opinions as well. Drop me a line at the above address, or via CompuServe at 75036,2501 or Delphi at MARCWA3AJR. I'm always delighted to hear from you. 73

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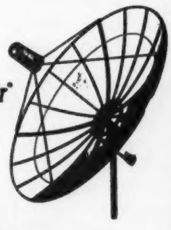

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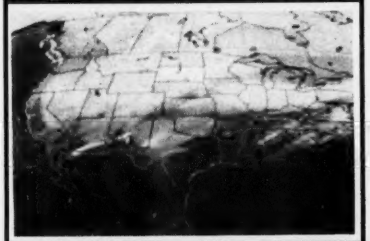

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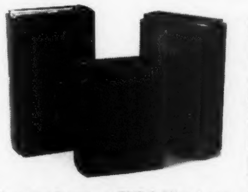

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The Microsats—a Half-Year Later

How have the Microsats fared since the launch earlier this year? After six months in orbit there has been a little lost ground but a lot of progress.

During much of the first half-year of Microsat activity, DOVE (Dove-OSCAR-17) was silent on the 2 meter downlink due to software difficulties and the CPU crash in March. Command stations like N4HY could hear and decode the 2.4 GHz signals from the satellite using S-band receive systems in conjunction with DSP (digital signal processing) techniques, but those looking for the strong 2 meter FM packet and synthesized voice signals on 145.825 MHz heard nothing. During the recovery (see the June, 1990, "Hamsats" column) engineers were careful to ensure that no problems would occur when the 2 meter transmitter was enabled.

By the time you read this, DOVE should have a powerful 2 meter downlink with both packet and programmed voice messages. Every point on Earth is within range of the signals from DOVE at some time during each day. With nothing more than a simple VHF-FM receiver, anyone can listen to the digitally-encoded voice messages. Add a TNC (terminal node controller) and a terminal and the packet telemetry and messages can be received as well.

Many people have asked why the BBS systems for the Microsats took so long to activate. The Microsats were designed and built by AMSAT volunteers. The scientists and engineers responsible for creating the Microsats also have job and family commitments. In addition to the BBS programming, volunteers also handled the DOVE recovery, hardware experiments, the UoSAT-14 high-speed digital communication activity and worked with the WEBERSAT (Weber-OSCAR 18) camera.

The Binary Format

Experimental work with binary-format telemetry downlinking has begun via LO-19 (LUSAT-OSCAR 19) and AO-16 (AMSAT-OSCAR 16).

The early downlink format was standard ASCII, but a binary form is expected to dominate for both message uplink, telemetry and message downlink operation. It is more efficient, but requires that user TNCs (terminal node controllers) be commanded for KISS ON (Keep It Simple—Standard firmware bypass) and a separate program running in the user's computer to provide packet control.

To enable KISS, the command "KISS ON" is sent to the TNC. The TNC will reply that "KISS" was "OFF." Nothing will happen until the TNC is turned off and then on again or the "RESTART" command is used. At that time, the lights on the front of the TNC will flash a few times and the unit will be ready for external packet control with "KISS ON." Appropriate Microsat TNC software will soon be available without charge through BBS systems. Disks will also be available through AMSAT for a small fee to cover costs.

Originally KISS was provided to support the use of TCP/IP (Transport Control Protocol/Internet Protocol) software running in a host computer connected to the TNC. Almost all TNCs built since 1983 support KISS. It's only an inconvenience for those with computers to use software external to the TNC's internal programming, but is impossible for those with stand-alone terminals or computers not supported by available programs. The binary code will show nothing comprehensible on the screen.

Stations that have been receiving and decoding pictures from WEBERSAT have been using the KISS mode in conjunction with N4HY's program TLMDC Version 3 to capture the binary picture files.

Data can be collected and saved to disk during a pass. Another program, Weberware 1.0, developed at Weber State University, decodes the files and presents the results on PC-compatible computers with at least EGA video capabilities. The latest version of the decoding software was on display at the Dayton Hamvention in April and can be purchased from AMSAT.

The binary format will not be used on DOVE unless BRAMSAT wishes to try it. A complete list of frequencies and modes for the Microsats appeared in this column in the May 1990 issue.

The Bottom Line

On the plus side, the amateur community has four operational Microsats. Upgrades to onboard operating sys-

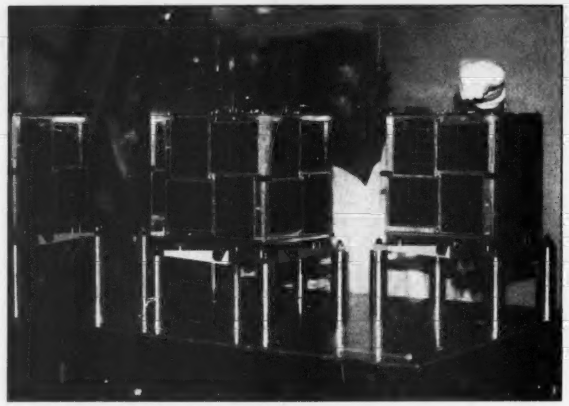

Photo B. Jack Crabtree AA0P making final adjustments to a Microsat prior to vacuum chamber testing. (Photo by WD0HHU.)

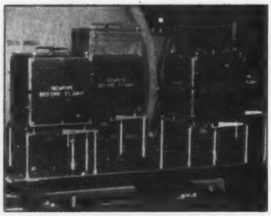

Photo C. The microsats with solar panel covers in place. (Photo by WD/ 0HHU.)

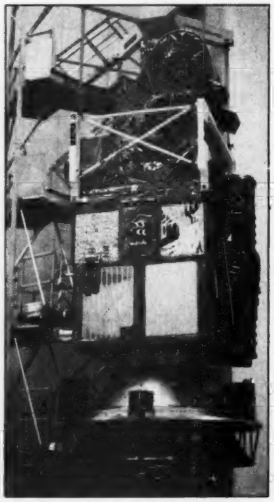

Photo D. The French SPOT-2 satellite dominates the scene while the microsats and UoSATS are attached below. (Photo by WD0HHU.)

Photo A. Jan King W3GEY and the Microsats during vacuum chamber testing. (Photo by WD0HHU.)

Photo E. WA5ZIB explaining the amateur satellite program to the Brazos Valley Amateur Radio Club near Houston. (Photo by N5MPN.)

tems may be long in coming, but the results are worth the wait. All four are healthy. Very few organizations in the world today, especially volunteer groups, could hope to get four satellites off the drawing board and into space in such a short time.

When final commissioning occurs, control of each satellite reverts to the groups sponsoring the individual satellites. DOVE is owned by AMSAT Brazil, or just BRAMSAT. LUSAT or LO-19 is the property of AMSAT Argentina and WEBERSAT belongs to Weber State University in Ogden, Utah. PACSAT or AO-16 is the only hamsat of the group that will be directly controlled by the operations arm of AMSAT North America. Although cooperation between groups is expected, the final say on schedules, software uploads and system activities is the responsibility of each organization.

AMSAT "ACs"

Nearly every ham club wants speakers to provide informative talks at their meetings. Anyone who has been in charge of organizing club programs knows how hard it is to find speakers. AMSAT has a group of volunteers called Area Coordinators. One of their jobs is to give talks about the amateur satellite program. With ten operational hamsats in orbit, and more on the way, there are enough fascinating topics to provide hours of information. There are ACs in all 50 states. To find one near you, give AMSAT a call at (301) 589-6062, or write to: The Radio Amateur Satellite Corporation, 850 Sligo Ave. Suite 600, Silver Spring, MD 20910. Don't forget to include a self-addressed-stamped envelope.

The Area Coordinators also help those with questions on a one-to-one basis, promote AMSAT at ham conventions, run local hamsat-oriented nets, give demonstrations at schools and provide assistance wherever needed to "get the word out" to the amateur community and the public concerning the amateur satellite program. ■

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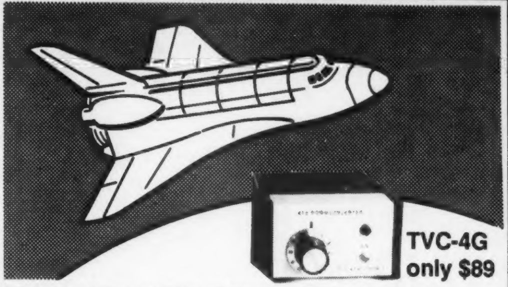

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CIRCLE 295 ON READER SERVICE CARD

Yaesu Service Survey

Refreshingly flexible.

by Gordon West WB6NOA

After visiting a service facility, I can usually sum up my feelings about it in just a few words. Kenwood is "professional and firm"; ICOM is "cordially professional and reliable"; and Ten-Tec is "professional but relaxed." I would call Yaesu, subject of this month's service survey, "professional and very flexible." Believe me, this is not a contradictory statement!

While I waited for Customer Service Manager "Johnny" Johnson N6TVL to show me the service facility, I knew what I was in for. Overhearing Parts Department Manager John Lynn as he worked with a ham on the phone, I couldn't help but notice his interest in helping the customer: "...and after you take your handheld out of this set-up mode, you will be able to tune in 5 kHz increments...and by the way, if you have just a minute, let me tell you another trick that will make programming your new Yaesu 727 handheld a little easier...."

Now that's refreshing—extra effort given in a casual, friendly way by Yaesu's technical phone personnel to make life easier for the customer working with a new and complicated dual-band handheld! Such one-on-one assistance speeds up the time it takes to learn all the transceiver's multiple functions.

The Yaesu Service Center is located in a new, modern industrial area in Cerritos, California. (This is scarcely a mile from where that Mexican airline came down after a firey tangle with a private airplane). The Yaesu service team consists of 15 bench technicians, plus many staff personnel that track all sets in for repair. Vice-President Chip Margelli K7JA says that most service personnel are U.S. citizens. All were busily working on equipment that was unbelievably small and complicated.

Johnson: "While most of our personnel are cross-trained to repair different rigs, we have some technicians that specialize in certain HF sets and VHF handhelds." However, he adds, "We cross-train as many of our personnel as possible—that way we are always ready when an abundance of VHF or HF repairs come in."

Every incoming piece of equipment is logged in on the computer. Included accessories are also noted. But "Don't send us your accessories unless they may have led to the repair problem," Johnson says. In other words, if you're sending back a handheld, remove the battery and rubber duckie antenna to cut down on weight and to minimize the number of items the technician must keep track of.

Photo A. Chip Margelli K7JA (left) and "Johnny" Johnson N6TVL (right).

Give the Facts—All of Them

It was interesting to note that the customer's original letter describing the complaint is an integral part of the repair package. This hasn't happened at most of the other repair facilities; usually, someone transcribes the letter onto the repair form and the letter gets tossed. At Yaesu, the letter is packed right along with the computerized repair order form so the technician may read for himself the problem described by the client sending in the equipment.

"Never enough—never enough—never too much," says one Japanese service technician, reading a brief letter from a customer describing the problem. I can see what he means: "Radio doesn't work after 5 minutes." What does he mean? That the radio doesn't work on transmit? On receive? That the PL doesn't work after 5 minutes? Or is it the touch tones that don't work after 5 minutes?

Yaesu's service personnel suggest: "Describe the fault in as much detail as possible. Give us all the facts behind this set quitting. Tell us how it's mounted. Tell us what kind of antenna it's plugged into. Tell us more—tell us more!"

Identification, Please!

Margelli and Johnson led me over to a special bin marked with a giant question mark. Some nice rigs in here—three or four new handhelds, an FT-726 satellite base station, three 101s, and about four older 207s. All were completely repaired, just waiting to be returned to their rightful owners.

And waiting...and waiting...and waiting. Each of these radios had been sent in within the last six months with absolutely no return address, no letter inside, and no personal identification number found on the inside or outside of the equipment.

"It's hard to believe that someone would send us their $2,000 radio with absolutely no documentation, but it happens regularly," says Margelli. Are you missing a Yaesu repaired radio? If so, better figure out a way you're going to convince the Yaesu gang that one of these unclaimed radios is really yours! How does Yaesu personnel identify the rightful owner? "We have our ways," Margelli says with a smile.

Details of Yaesu Service

Every afternoon is phone time for some of the customer service technical personnel. They call customers to field questions or let them know that their unit has been fixed. Like most companies, Yaesu sends a postcard or calls the customer on the phone when their repaired equipment is coming COD, requiring cash or a cashier's check.

What are the average repair costs?

- High frequency sets: $125
- VHF transceivers: $75–$125
- VHF/UHF base stations: $75–$125
- Hourly rate: Approx. $50 with "oh my God" factor (difficult repairs that take substantially longer to fix than the actual repair charge indicates; the amount is adjusted depending on how many "oh my God" factors apply).

And what about the warranty?

- Warranty/parts & labor: 90 days
- New FT-1000 warranty: 1 year

All warranty claims for Yaesu equipment must be substantiated with a proof of purchase receipt.

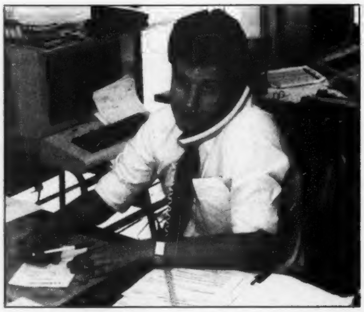

Photo B. John Lynn providing customer service technical help.

Photo C. Work begins on a base station zapped by lightning. Many lightning-struck rigs are unrepairable.

Yaesu's repair warranty is valid only for the original purchaser. If you are buying a relatively new set still in its warranty period, chances are the warranty will not be transferred to you.

- Biggest headache: Poorly packaged equipment that suffers additional damage in shipment. (Not the first time we've heard this one! Before you tape up the box, be sure your equipment is cushioned against impact. Don't use crushed newspaper; it isn't springy enough.)
- Common abuses and accidents: Dropped sets, lightning strikes, water & beverage damage (you say you keep your coffee warm on top of your FT-???), and cigarette smoke. That's right, the tarry substance in cigarette smoke builds up on the plates of tuning capacitors in the big HF transceivers. This causes the plates to accumulate dust, which in turn accumulates moisture. Eventually the caps arc, and once you've toasted some plates in this section of the final, the entire variable cap will need to be replaced.

"It's always a good idea to blow out the dust that has accumulated inside your set," says Margelli. "And if you are a heavy smoker, you might even take a look for yourself to see how much substance has built up on the plates of the caps—but," he cautions, "do this carefully, with the unit unplugged, and all capacitors safely discharged."

I asked Yaesu about the lithium batteries in their equipment. Will they ever go bad, requiring you to send the set back to the factory for reprogramming? The answer was a pleasant NO. The lithium batteries do not manage the CPU's operating system.

Out-of-band modifications are overlooked unless the modification affects the operation of the radio. "And we have plenty of out-of-bands attempted with a 300 watt soldering iron. This is an expensive repair," says one bench technician. If you plan to play games with your Yaesu for out-of-band reception, better leave it to a pro.

Well-Stocked for Action

Yaesu maintains a huge selection of parts. New, old, and antiques. Some dog-bone boards may be scavenged for parts, or trouble-free boards might even be used for replacements on older units to solve an intermittent board problem.

As for service manuals, Yaesu carries every technical manual back to the birth of the radio. Some may be copies of the original, but nevertheless they are available for the buying. "Parts and manuals normally turn around in about 24 hours when ordered," Margelli says. Items like tone boards, crystal filters, and flexible antennas are considered dealer sales, not parts orders. See your local dealer for these normally available accessories.

However, tubes are getting to be a problem at Yaesu, as they are at all other companies. That is, good tubes. For instance, finding good 6JS6s for the 101 series is tough. If you have some hanging around your shack, better hold onto them. Good tubes are getting more scarce every year.

More on Damage by Lightning

As noted above, lightning is a common source of damage. The phone customer service personnel frequently repeat this advice to amateur operators, especially those in the Midwest and South: UNPLUG YOUR EQUIPMENT, AND DISCONNECT THE ANTENNAS WHEN NOT IN USE!

Numerous radios come in that are completely in meltdown from a direct lightning strike. Most of these sets cannot be repaired. If you suspect a lightning storm is brewing, get your equipment completely off the AC, ground lines, and antenna lines. During an ocean race to Hawaii, my sailboat was hit by lightning, but my set faired well because I had unplugged it and rolled it up in a sleeping bag. That's one way to beat the lightning gods!

Yaesu gets some interesting repairs. Of course, the lightning repairs look like one molten mass with a resemblance of a dial as a blob in the front. While the former cannot be fixed, Yaesu accomplished an outstanding success on another unusual repair job—an FT-901 that was shot by a Panamanian bullet. The bullet went completely through three boards and exited through the top of the unit. There was no word on the condition of the operator!

Regional Service with GEES

Yaesu has recently contracted with General Electric Electronics Services to handle regional repairs. GEES is over 20 years old. The G.E. service lab normally calibrates electronic test equipment and repairs RF equipment. GEES has 22 facilities across the country. The Chicago operation is the pilot shop for this new service venture, with the Cincinnati operation acting as the back-up facility for Yaesu service. The GEES Compton facility in California will be the next shop to come on line, followed by one in Seattle.

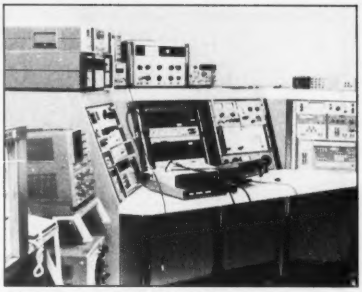

Photo D. It's high tech in this environmentally-controlled calibration and alignment lab at the GEES repair facility in Illinois.

Gary Frisch WJ9G says, "Our only product is service, not new equipment. Every employee is involved in a single function, providing quality repair service. We also offer fixed pricing." Their fixed "cost to repair" includes labor and all parts, excluding major parts or equipment that has been seriously damaged by the operator. The GEES offers one-week turnaround time, and the fixed rate for most HF rigs is $140. Mobiles are $110 and handhelds are $80. However, call the GEES at (708) 595-4343 to double check the current price before you send your equipment in.

The General Electric group also repairs Kenwood equipment. As we pointed out in past service surveys, regional service centers, or in this case a GEES, might be the perfect solution for a fast repair, a guaranteed repair rate, or a difficult (unusual or complex) repair. Give the GEES a call if you live in the Central or East U.S.

Mailbox Comments

What do hams say about Yaesu service?

Fred Crouch WD9FBY was plagued with an FT-757 intermittent keyer. The repair charges were $120, which he felt was reasonable, and the service was prompt and thorough. "Service was faster than estimated. I was treated with courtesy and all the options available were explained."

Dean W5UNK comments that his 757 was repaired and "RF aligned," but when he checked it about a month later, it was 500 hertz off calibration, and the squelch only worked on FM. He also claims that the service manual is not up to date on this set.

Bill KA2OVR owns two Yaesu HTs, and he feels that they are excellent equipment. He says he hears negative comments about Yaesu, ICOM, and Kenwood service, and that the best service hams talk about is from Ten-Tec. He said he was willing to pay for expe-

Contacting Yaesu

Vice-President/Customer Service: Chip Margelli K7JA, of DX fame
Customer Service Manager: "Johnny" Johnson N6TVL
Hot Line: (213) 404-4884
Parts Hot Line: (213) 404-4847

- Incoming repairs should be sent directly to Yaesu, U.S.A., 17210 Edwards Road, Cerritos, CA 90701. Package it well!
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Contact GEES for regional service news, as new facilities are due to open.

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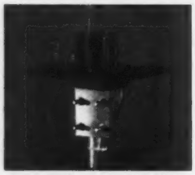

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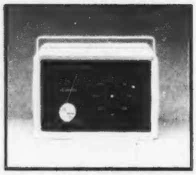

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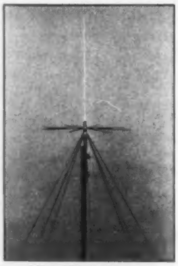

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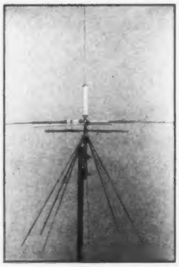

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dited repair, but Yaesu did not have that type of service. To our knowledge, no company offers expedited repair, but Bill ends his letter by writing that the service was "disgraceful."

Ken Freeland W1ANF sent his FT-980 in for a power supply 24 volt regulator fix. The repair cost about $100, which he felt was "a little high," but he gives the phone personnel stars for being helpful.

Margaret Foster WA6BWH says, "My Yaesu FT-23R has given me years of trouble-free service. It's been bumped around and dropped, but still continued to perform. Then one day it quit. Off to Yaesu, UPS. In less than a week, it was repaired and the price was right. I am happy with Yaesu service."

> ***"It's a 'happy' company, and the spirit of the Yaesu personnel is indeed on the customer's side."***

And James KC4ODF: "My FT-757 came back repaired in a month, faster than I had been told, and if UPS had been faster, turnaround time would have been less. . .I repaired my FT-2100B linear amp myself, and the person in the parts department knew the parts I needed. In one case, he had to pick the parts by hand, as they had been packed with the wrong part number. The one problem I could not find the cure for was taken care of by a telephone call to a technician named Ron. He knew the problem and the solution."

Here to Please

Approximately 10 other letters echoed the same fast and efficient service that Margaret Foster experienced with Yaesu. All commented that the equipment was repaired professionally, quickly, and at reasonable cost.

Visiting Yaesu was a casual delight. It's a "happy" company, and the spirit of the Yaesu personnel is indeed on the customer's side. I noticed one rig, after repair, was getting a complete scouring. "Chances are, he will probably think we sent back someone else's unit," a technician said, smiling, as he buffed up the face of an FT-101, previously brown from years of cigar smoke. "I could probably tell you the brand of cigar this operator was using, too! After this cleaning, it will look like a brand new set." He polished off the final knob.

It's that kind of personal care that makes Yaesu service a casual affair. True, in the past not all hams have been happy with Yaesu service—but with the new service program with GE, plus added service personnel and new test equipment, Yaesu is out there to please.

In the words of KC4ODF: "I have heard that all you buy is a NAME, and if that is true, I'll buy that NAME, one I can trust. . .I have found this in the people and products from Yaesu in Cerritos. . . 73

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73 Review

by Ron Hranac N0IVN

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Price Class: See table.

Fast scan amateur television is a mode of communication that has been with us for a long time, but the last few years have seen incredible growth in the ranks of ATVers and new products to support that interest. While ATV equipment suppliers like PC Electronics and Wyman Research are familiar to most of us in the fast scan ranks, recent entries into the world of video include AEA with their FSTV-430a transceiver, and Yaesu's 23cm ATV module for the FT-736.

One of the newest ATV manufacturers to join in the fun is T.D. Systems of Pantego, Texas. Operated by Steve Franklin WB5KGL, TDS is producing equipment that redefines the "amateur" in ATV. Based around a compact transceiver control unit, a ham's operating flexibility is enhanced with the use of separate transmitter and receiver modules that can be mast-mounted to eliminate the need for expensive low loss coax. The control unit remains in the shack, with connections to the modules via inexpensive RG-59.

Whether your fancy is AM or FM video transmission, on-carrier or 4.5 MHz subcarrier sound, and simplex, crossband (full duplex), fixed, portable or repeater operation in the 70cm, 33cm or 23cm bands, the TDS gear can be configured to almost any combination you can imagine.

The Control Unit

The CU-125 ATV control unit (Photo A.) is the heart of TDS's fast scan gear. The front panel includes illuminated level meters for both audio and video modulation, and features momentary-contact pushbutton electronic switching for POWER on/off, MIC or AUX AUDIO input, SUB C (4.5 MHz audio subcarrier) on/off, XMIT, CAMERA or AUX VIDEO input, and XMIT FREQ selection between two transmit frequencies. Level controls for the microphone, auxiliary audio, camera and auxiliary video inputs are front-panel pots, as is the receive tune control. LEDs located above each pushbutton illuminate when the button is pressed, and two additional LEDs are located next to each meter to indicate audio and video clipping. The two LEDs above the XMIT FREQ button will let you know which transmit frequency is being used. The front panel also includes separate MIC and PTT jacks.

The rear of the control unit (Photo B.) is equipped with a number of connectors and switches; the following is a summary of the purpose of each one:

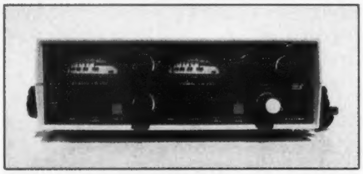
Photo A. The CU-125 control unit is the heart of TDS's ATV gear.

AUX VIDEO IN phono jack—This is a second video input to the control unit, and can be selected with the front panel AUX VIDEO pushbutton. You can connect 75 ohm, one volt peak-to-peak video sources, such as a VCR, second camera, color bar generator, or composite video from a computer or video game.

VIDEO MON OUT phono jack—This provides a sample of your transmitted video after clipping and low pass filtering, just before the line driver that feeds an external transmitter module.

DUP SIM switch—For simplex operation, the switch must be in the SIM position. This routes an internal RF modulator to the OUT TO TV connector when the transmitter is on, so you can see to your own signal while in the transmit mode. During receive, the receiver module's signal is routed to the TV. With the switch in the DUP position, the internal RF modulator is disabled, and the receiver module's signal is routed to the OUT TO TV connector when transmitting or receiving.

AM FM switch—For normal TV operation, this switch is left in the AM position. For FM video operation, an optional FM demodulator board must be installed in the control unit. When switched to the FM position, the demod's received video and audio are routed to the internal RF modulator to allow reception on a regular TV set. In addition, the receiver module input signal is connected to the demod, and the receive tuning control is applied to the demod board for AFC action. Next it's routed to the receiver module.

VIDEO TO XMIT F-connector—Using RG-59 or other low cost coax, this is connected to the F connector on an external transmitter module, and provides video and 4.5 MHz audio to the module as well as bias voltage when the front panel XMIT button is pressed.

F_1F_2 SELECT OUT phono jack—If a second crystal has been installed in the transmitter module, the center conductor of this connector should be connected to the green wire of the transmitter module wiring harness. This will allow remote frequency selection using the front panel XMIT FREQ button.

INT CR AUDIO TO XMIT phono jack—When on-carrier audio transmission is desired, this jack will provide pre-emphasized audio to the transmitter module. For on-carrier audio operation, this optional feature must be installed in the transmitter module (the fourth pin on the module power connector and white wire in the wiring harness are used for on-carrier operation).

AUDIO MON OUT phono jack—This provides a sample of your transmitted audio after pre-emphasis, clipping and filtering (before level adjustment) prior to the modulator stage.

	Prices, According to Configuration	
CU-125	Transceiver control unit	$229
	AM Transmitter Modules (Double Sideband)	
T70A	70cm transmitter module	$132
T33A	33cm transmitter module	$137
T23A	23cm transmitter module	$137
	2nd transmit frequency	$ 10
	On-carrier audio	$ 10
	FM Transmitter Modules	
T33FM	33 cm transmitter module	$138
T23FM	23 cm transmitter module	$138
	FM demod board for CU-125	$169
	Receiver Modules	
RVT70	70cm downconverter	$ 89
RVT33	33cm downconverter	$103
RVT23	23cm downconverter	$109
	crystal-control RX option	$ 30
RCC10	Downconverter control box (allows stand-alone operation of a downconverter for AM reception without the need for CU-125 control unit)	$ 54
C70	70cm indoor downconverter/receiver	$109

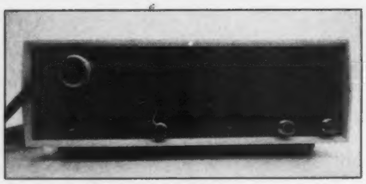

Photo B. External connections are made on the rear panel.

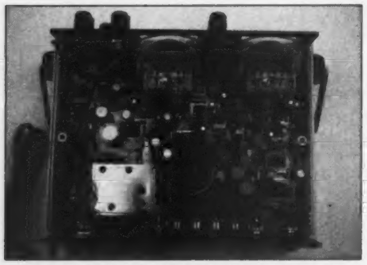

Photo C. The CU-125 control unit's quality is evident in its construction.

AUX AUDIO IN—This is a second audio input to the control unit and can be selected with the front panel **AUX AUDIO** button. Line level sources such as VCR audio outputs can be connected.

TO REC CONV F-connector—The external receiver module is connected here with RG-59 or equivalent. This provides operating power to the module, and is the receiver's IF input to the control unit.

OUT TO TV F-connector—This provides VHF channel 3 or 4 to a regular TV set and allows monitoring of received signals during simplex or duplex operation, as well as transmitted signals during simplex operation.

CAMERA 10-pin connector—This is a standard 10-pin connector for a video camera that provides power to operate the camera, and video and microphone inputs from the camera.

12 VDC IN cable—This is for connection to an external DC power source (10.5 to 15 volts). Built-in regulation circuitry compensates for voltage fluctuations, and provides the required internal operating voltages. Because of this, it is not necessary to readjust the control unit's internal blanking pedestal or sync stretcher if the operating voltage changes.

The control unit is housed in a smart looking plastic case 8"W x 2½"H x 6¼"D, not including the rubber mounting feet, front panel knobs or folding support bracket. The whole thing weighs just over a pound. When the control unit's power is first turned on, **MIC**, **CAMERA**, and **XMIT FREQ** F_1 are automatically selected. If you use 4.5 MHz subcarrier audio, then **SUB C** must be pressed each time you turn the power on (it would be nice to be able to change the default to have the subcarrier come on at power up).

The quality of workmanship is excellent, with parts layout and construction definitely in the "professional" category (Photo C.). The control unit includes a sync stretcher circuit for compatibility with external RF power amplifiers.

External Modules

The actual transmitter and receiver modules are in 3¾" x 4¾" x 1⅜" die-cast aluminum Hammond housings (Photo D.), and can be mounted at the antenna or some other location remote from the control unit. This allows the use of inexpensive RG-59 coax to interconnect the modules to the control unit. For connection to their respective antennas, the modules are equipped with 50 ohm female N connectors.

The transmitter modules also have a small 4-pin power connector and come with a short wiring harness that includes a plug to match the power connector on the module. This wiring harness contains a +12 VDC line (red), ground (black), and frequency select line (green). There's a white wire for on-carrier audio operation. If the transmitter module is mounted any distance away from the control unit, you will have to splice in a longer multi-conductor cable. The modules are built using surface mount device technology (Photo E.), with the circuit boards and external connectors in the lids of the housings.

All of the receiver modules have low loss internal bandpass (preselector) filters followed by GaAsFET front ends for out-of-band signal rejection and low noise performance. Conversion gain is around 20 dB, with an IF output in the VHF television low band (50 to 90 MHz). Standard configuration is for tunable receive using 10 to 15 VDC for tuning across the desired frequency range. Receiver modules may be changed to crystal control with an optional add-on board; frequency F_1 is then selected by applying 10 to 12 VDC, and F_2 is selected with 12 to 15 VDC. Frequency control voltages are fed from the control unit to the module through the interconnecting coax.

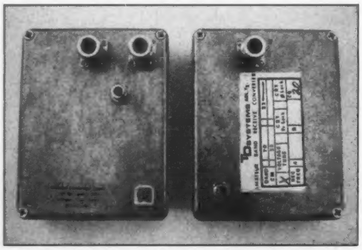

Photo D. External transmitter and receiver modules are enclosed in small Hammond aluminum housings. The second N connector on the transmitter module interconnects to a receiver module for in-band simplex operation.

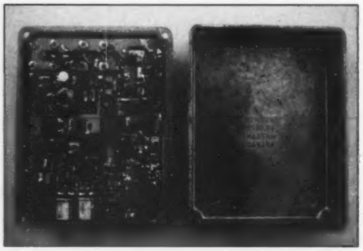

Photo E. The modules use surface mount device construction, with all components in the lid of the housings.

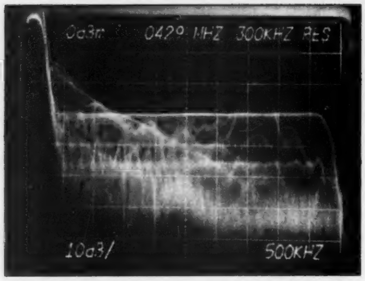

Photo F. TDS transmitter in-channel video frequency response measured with a SIN X/X test signal is good even by broadcast standards.

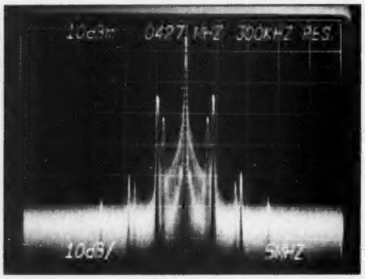

Photo G. The transmitted RF spectrum is clean; an external attenuator was used to keep the 2 watt signal from overloading the spectrum analyzer.

Transmitter modules can operate on two output frequencies. AM modules use crystals (output frequency divided by 64), and the FM modules use two diode frequency programming banks. Even though the transmitter modules have external power through the 4-pin connector, the module won't actually transmit until video and bias are present on the coax that interconnects the module and control unit. AM operation is available on 70cm, 33cm and 23cm; FM operation is available only on 33cm and 23cm. 70cm output power is rated at 2 watts (sync tips); 33 and 23cm output power is 1.25 watts (sync tips for AM and carrier level for FM).

Performance

The configuration I tested included the CU-125 control unit, a T70A transmitter module, and an RVT23 receiver module. The transmitter module was crystalled for 426.25 MHz and 439.25 MHz operation with 4.5 MHz audio subcarriers (on-carrier audio was not installed), and the receiver module was the standard tunable version (1240–1290 MHz). This setup allowed full duplex operation and compatibility with Denver's crossband ATV repeater.

The control unit's current consumption at 13.8 VDC was measured at 0.46 amp with both modules connected and in receive mode; with a camera powered through the rear panel's 10-pin connector, current was 0.75 amp. Turning the transmitter on increased the figures to 0.51 amp and 0.81 amp, respectively. The transmitter module required a separate 0.43 amp (transmit mode) through its wiring harness, for a total of 0.94 amp without a camera and 1.24 amps with a camera.

Actual output video carrier frequencies were 426.2503 MHz and 439.2504 MHz, with the 4.5 MHz audio subcarrier at 4.500981 MHz in both cases. The transmitter's second harmonic was −64 dBc, and with the audio subcarrier set to −20 dBc and 1 volt of video applied at 87.5% depth of modulation. The 920 kHz beats were −40 dBc. I also noticed some beats 1.25 MHz either side of the video carrier, but these were −62 dBc and did not produce any visible interference in the picture. The video level meter read just over 100% with 1 volt of video input and depth of modulation at 87.5%. The audio level meter read about 70% with a 1 kHz tone input and 25 kHz peak deviation. The clipping LEDs came on at 95% depth of modulation and 30 kHz deviation, respectively.

CW output power was 1.58 watts, and with video modulation applied, this increased slightly to about 2 watts on the sync tips. In-channel video frequency response was extremely flat at better than 0.5 dB peak-to-valley (see Fig. 6). With the 4.5 MHz audio set to −24 dBc and video modulation at 87.5%, the double sideband spectrum was quite clean (Fig. 7).

The transmitter was then connected to a Mirage/KLM D24N-ATV power amp, and the CU-125's pedestal and sync stretcher controls adjusted for best operation. Using a 10 element KLM yagi, picture quality through the Denver ATV repeater (22 miles away) was a solid P5. Even with the 4.5 MHz subcarrier set to −24 dBc, there was no audible noise or buzz in the sound.

I was able to test the receiver module on a Hewlett-Packard 8970B noise figure meter, and the module's noise figure (including its built-in preselector filter) was nearly flat across the 6 MHz spectrum at about 2.2 dB. Conversion gain was 20 dB at the video carrier frequency, and about 19.5 dB at the upper 4.5 MHz audio subcarrier frequency.

Even after continuous operation for up to an hour, the equipment was only warm to the touch. I installed the modules near the control unit, since I have only 30 feet of Belden 9913 coax between each antenna and the shack. With a received carrier level of −57 dBm from the repeater, the TDS receiver module provided crystal clear pictures.

Comments

On-air use for several months has confirmed what I measured during this evaluation. The TDS equipment's transmitted and received picture, color, and sound quality are better than other ATV rigs I have used in the past, and picture sharpness is visibly better. The TDS receiver module performs extremely well under relatively low signal level conditions and in the presence of strong out-of-band interfering signals that make pictures on other units almost unwatchable.

I do have two complaints, though. Documentation needs improvement, and delivery is slow. These two items aside, TDS has some excellent ATV equipment. For user flexibility and product quality and performance, it's hard to beat. 73

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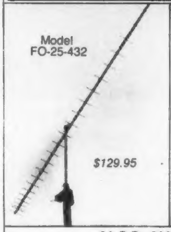

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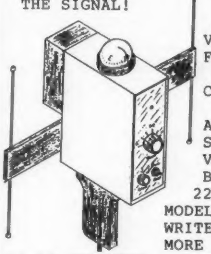

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Model Rocket ATV

Warp-Speed Television.

by Bob Rau N8IYD

In 1987 the model rocket *Argus II*, a developmental vehicle for technological testing, flew for the first time. The payload of the 4-inch diameter, 101-inch tall rocket housed a Sony XC-37 black and white CCD camera, and a PC Electronics TXA5 ATV transmitter. With Blake W8MNT as control operator, the *Argus II* lifted off using an Aerotech H120 and four Vulcan G-44 rocket motors, the equivalent of almost 40 Estes D motors.

Preparing the Argus II

I had mounted the camera horizontally on the rocket, with a mirror in an external housing. During ascent, the mirror looked down the side of the rocket at the ground; after ejection, the mirror flipped out of the way and looked at the horizon.

I had also removed the XC-37's internal power supply and made a little PC board so the camera could sit horizontally. The TXA5 had the frequency selection relay removed and the crystal soldered in to make the unit more immune to shock and vibration.

There was also a radio control uplink to activate a backup parachute and tracking smoke. Nine alkaline AA cells powered the entire system. I designed the rocket to be as light as possible, using a balsa and fiberglass tubing superstructure. The body tubes could be lightweight Estes BT-101, since they were just an aerodynamic skin. With motors, the entire stack weighed just under 6 pounds.

Ready for Launch

We started preparing for the launch early in the morning. I set up my ATV receive site a hundred or so feet from the launch pad with a backup receive site down the road. The site got the best video using a simple Radio Shack corner reflector. We also had a third receive site, the ARROW Communications Association ATV repeater (W8MNT/R) 20 miles away in Ann Arbor, Michigan. By early afternoon we were ready for launch, although with some minor problems. The video transmitter was interfering with the radio control receiver a little. This caused the servos to jitter, which in turn caused the power bus to fluctuate a little from the servo motors. The power fluctuations showed up as random white bands on the video. Except for the interference, things looked good for a launch.

. . .3, 2, 1, LAUNCH (See Photo B). One G-44 motor started before the rest, creating a nice smoke cloud a second before lifting off. Although not the most efficient way to get a rocket off the ground, the video was fabulous! We watched the rocket race away from the ground on a tower of smoke (see Photo C). Through the repeater, the video was seen 26 miles away in Tecumseh, Michigan. A snag in the recovery system caused the parachute not to deploy, which damaged both the launch vehicle and the payload section, but the electronics sustained very little damage.

Photo A. Carolyn KA8ZWM and Bob N8IYD with Argus IV.

Photo B. Liftoff of Argus II!

The Next Rocket

The next goal was for more altitude. I ran several computer simulations to find the most economical way to reach an altitude greater than one mile. Rocket motors costing what they do, I chose to redesign the rocket using a 2.6-inch diameter tube. This smaller diameter would allow me to achieve nearly 60% more altitude for the same motor and mass. Using an Aerotech J125 (equivalent to about 70 Estes D motors), I could reach my mile-high goal. Since I was designing a new vehicle, I also wanted to expand the technical goals. I decided to design an on-board flight computer and overlay telemetry on the video downlink.

In addition to all the new hardware I now had to design and build, I had to figure out how to shoehorn the PC Electronics TXA5 into a usable area 2.25 inches across. It was about an inch too wide, and I thought I would have to design my own transmitter, a task I was not up to. Blake W8MNT studied the PC board and suggested I simply saw the board down to size. I thought Blake was kidding; that's like wanting a mini HT and sawing a larger one in half to get it! But Blake showed me that if I sawed the sync stretcher side, I would damage very little of the circuitry I really needed.

After more than a month of considering other options, I set up the drill press with a Dremel cutting disk. Then, lowering the Quill to 2.25 inches and locking it into place, I said a quick prayer and sliced the board. Then I removed the partial components from the sync stretcher. The replacement circuitry was put on a perfboard at the RF output, bringing the length to 8 inches.

While working on the TXA5, I was also designing the new flight computer and video overlay. Now, anybody in their right mind would be honoring the time-tested rule: "Keep It Simple, Stupid!" Right? Not me. I kept wanting one more thing. Furthermore, I had set a standard board size of 2.25 by 4 inches, with double-size boards at 2.25 by 8 inches for the transmitter and camera. The flight computer needed so many chips I had to use surface mount and stacking sockets. I packed 15 ICs and 13 connectors onto a single-size board (see Photo D and Figure 1). The board had a 9 x 3 jumper matrix for configuring the I/O, analog input, RS-232, serial peripheral I/O, battery backup for 32K bytes of RAM, 3 servo outputs, power, TTL parallel, 2 high current outputs, and switch input connectors.

I chose the Motorola MC68HC11 microcomputer because it has many on-chip I/O'S and Motorola provides plenty of free support. The MC68HC11 has the following I/O on the chip: UART, high speed serial I/O, EEPROM, timers, pulse accumulator, parallel

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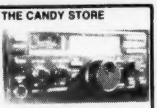

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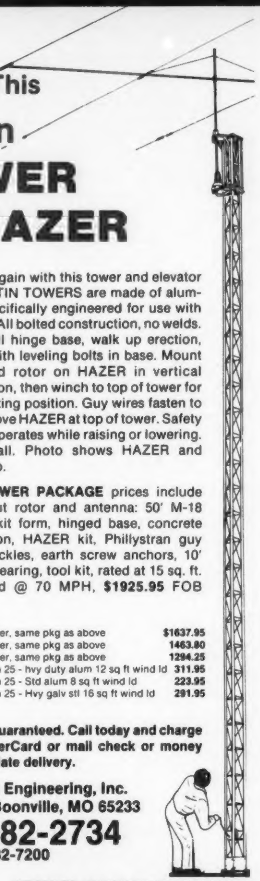

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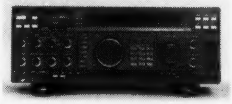

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Photo C. ATV payload rising on a plume of smoke.

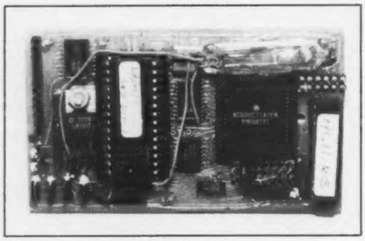


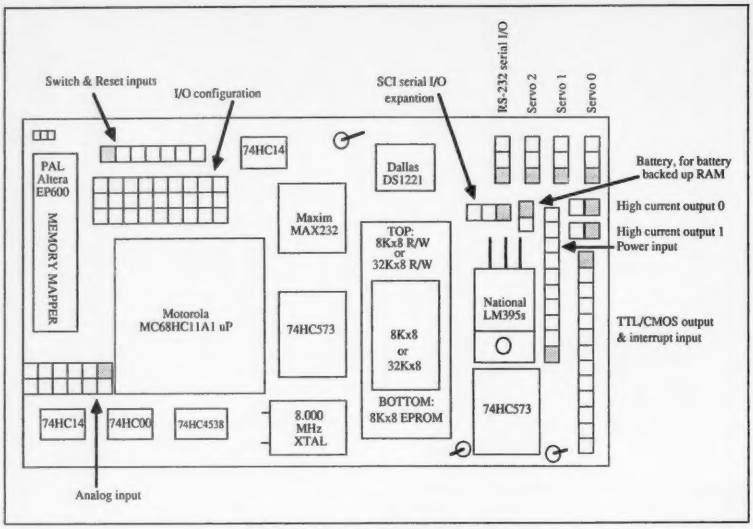
Photo D. MC68HC11 flight computer.

ports, and an 8-channel, 8-bit analog-to-digital converter. Motorola runs a Freeware BBS in Texas with cross-assemblers, BASIC interpreter (called BASIC11), hex monitor (Buffalo), C cross-compilers, and more, for this micro. The cross-assemblers and cross-compilers are ported to the Apple Macintosh, Amiga, and IBM PC/XT/AT clones.

The BASIC11 was fast enough to hook the vertical sync to the interrupt on the micro and have the video overlay time-stamp each individual video field! A job far beyond the BASIC for the Intel 8052H and some others I looked at. The only drawback of BASIC11 was that it didn't support floating point math, but this was not a problem for our application. A long-time friend of mine, Jud Nichols, wrote a device driver for BASIC11 so that printing to the video overlay was as simple as the BASIC11 statement: 10JPRINTJ#3,"SPEED=";S1

The device driver saved us from having to use POKEs and the like to talk to our custom video overlay circuit. The device driver supported an addressable cursor, clear screen, backspace, and most of the ASCII character set. The BASIC11 interpreter was burned into an EPROM and the BASIC11 source was burned into another EPROM.

I had designed, layed out, etched and built three circuit boards: the MC68HC11 MPU board, the power supply board, and the camera carrier board with video overlay circuit. The analog board for signal conditioning the sensors for air pressure and temperature were put on a protoboard. Batteries and the internal mirror for the video camera were mounted on blank 2.25 by 4 inch boards. All boards were this size, except for the camera/video overlay and the modified TXA5, which were 2.25 by 8.0. I then had a plug machined to allow me to cast card guides into 4-inch lengths of coupling tubing. The coupling tube with two PC boards installed solder-side-to-solder-side would then slide into the 2.6-inch body tube of the payload section (see Photo E and Figure 2). But the camera and mirror board were so tall they couldn't fit in with the other boards. This modular approach made payload design easy and quick to change.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SCI serial I/O expantion
RS-232 serial I/O
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Servo 1
Servo 0
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MEMORY MAPPER
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Dallas DS1221
Maxim MAX232
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High current output 1
Power input
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74HC573
8Kx8 or 32Kx8
National LM395s
TTL/CMOS output & interrupt input
BOTTOM: 8Kx8 EPROM
74HC573
74HC14
74HC00
74HC4538
8.000 MHz XTAL
Analog input

Figure 1. Flight Computer layout.

The Second Rocket

Argus IV, 104 inches long and weighing 7 pounds, 1 ounce with the Aerotech J-125, was finally done (Figure 3). I decided the *Argus III*, still unfinished, would carry a 5.3-inch diameter Polaroid camera. The *Argus IV* payload was substantially more sophisticated than *Argus II's*. We used a stock Sony XC-37 and tapped into internal test points for horizontal and vertical sync to drive the video overlay. There were two pressure sensors, one for altitude and the other for velocity. There was also a low mass thermistor for measuring instantaneous temperature during ascent. A mercury switch used as a binary G switch monitored motor burnout. Battery voltage and mission elapsed time were also displayed.

The first line of telemetry included my callsign and the mission elapsed time in 1/60th of a second. The second line displayed speed, altitude, temperature, battery voltage and some status bits displayed in hex. (See Photo F, taken before calibration.) The camera had an internal mirror to look out of the body tube, and an external mirror to look down the side of the body tube at the ground. The external mirror hinged in such a way that when the ejection charge separated the rocket, the external mirror would flip out of the way, allowing the camera to view the horizon (see Photo G).

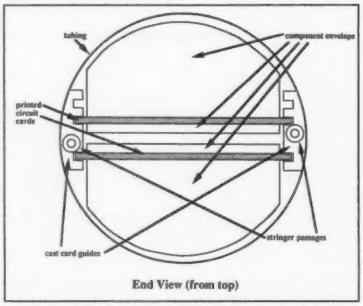
tubing
component envelope
printed circuit cards
stringer passages
cast card guides
End View (from top)

Figure 2. Rocket tube section with card guides.

The Flight Of Argus IV

Our first flight of *Argus IV* was in Danville, Illinois, at an advanced rocketry meet. I had coordinated this flight with some of the local ATVers in the area and told them I expected to fly at 10 a.m. As luck would have it, while setting up, an internal connector came loose and delayed the launch until 2 p.m. I was unable to make it into any of the FM repeaters to advise them of the delay, so no one else saw the flight. Due to a snafu before launch, we didn't get the computer reset correctly and never got telemetry. Oh, well.

. . .3, 2, 1, lift off! Unlike *Argus II*, this bird rolled like a bullet. After a few seconds, the image became so blurry you could only make out large objects on the ground. The motor burned for about 10 seconds and the roll rate reached 2 rps before burnout. Before

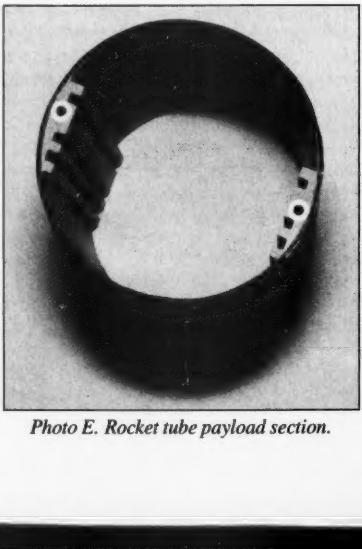

Photo E. Rocket tube payload section.

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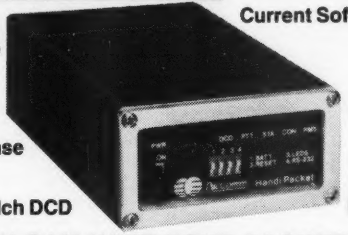

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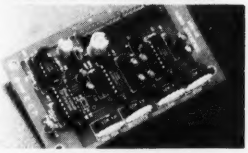

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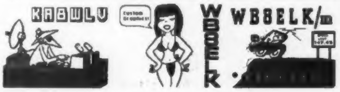

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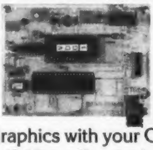

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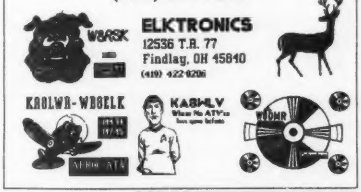

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Photo F. On-screen video overlay telemetry.

the rocket reached apogee, the roll rate had almost stopped and you could see fields and roads. Even without the telemetry, the flight was a great success.

I could never have accomplished these flights without the help of family, friends and the people mentioned above. I owe special thanks to my wife who got her Novice with me, helped build rockets, let me buy hundreds of dollars of gear to support each flight, drove with me across country for the flights, and took most of the pictures in this article. . .and is still married to me!

After Argus IV

The rocket and payload visited Dayton in 1989 and I gave a talk about it at the ATV forum. The telemetry electronics then went on to do service on two of Bill Brown WB8ELK's balloon flights. Bill grafted the flight computer, power supply board, sensor analog board and a copy of the video overlay board, onto a balloon payload.

I am currently working on a compact, video-only payload where I hope to have most of the electronics in a short, 4-inch payload section. A key requirement for this is an ATV transmitter small enough for the task. I discussed this problem with Tom O'Hara from PC Electronics at Dayton 1989, and he in turn discussed it with other people, and came up with the TXA5-RC ATV transmitter.

The World's Smallest

This exciting 2.25- by 4-inch transmitter, introduced at Dayton 1990 (see Photo H), is the smallest ATV transmitter board on the market. Should the size fool you, this is no slouch. The output power is 1.5 watts peak, up from 120 mW on the old TXA5. This transmitter also has a new feature: adjustable

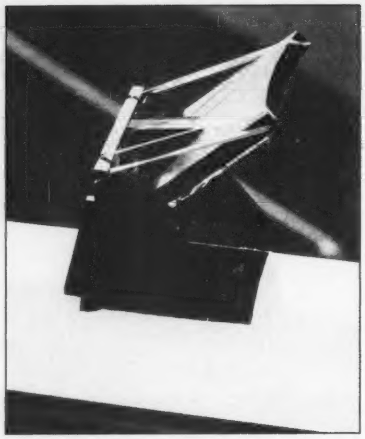

Photo G. Mirror mount for video camera.

transmitter output power. You can adjust the output power from 100 mW to 1.5W (with a B+ of 14 volts). This is important for two reasons:

First, this allows you to adjust your current consumption from 225 mA to 350 mA to get the best picture quality while prolonging the life of your batteries; and second, if you are using a radio control system, you can reduce your output power so you don't desense your radio control receiver input.

This transmitter also has solder pads for an SMB or SMC RF output connector. If you prefer, you can still solder the coax right to the board as on the old TXA5. Johnson PC mount SMB connectors are available from Digi-Key for less than two dollars each and mating females for less than five dollars. The video input and power have no facilities for connectors; you must solder the coax/hookup wire to the PC board. Although this board lacks audio input, it does have an audio carrier input so you can add the FMA 5-E sound subcarrier board. The sound subcarrier board is only 1.5 inches by 4 inches.

There is an adjustable sync stretcher circuit in the video modulator similar to PC Electronics's larger transmitters. The board has a crystal-controlled oscillator in the RF section near 106 MHz, one-fourth the output frequency. Therefore, any harmonics are kept out of the frequency range of the R/C receivers and the 2 meter voice coordination channels. There is also a demodulated RF output test point to aid in video adjustments, should

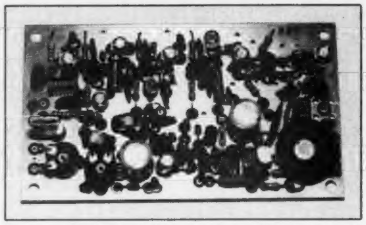

Photo H. P.C. Electronics TXA5-RC ATV transmitter.

you want to reset the output power or change the frequency.

Weighing less than 60 grams with SMB connector and power cable, this is an ideal ATV transmitter for ATV rockets, R/C Airplanes and balloons. The very small size is well suited for rockets and model aircraft. The hefty 1.5 watt peak output is also enough for the high altitudes of balloons.

The documentation includes a description, specifications, mounting, frequency readjustment, power readjustment, and instructions for video settings, as well as a schematic and parts placement diagram.

I took the transmitter over to Blake W8MNT's house and checked out the new TXA5-RC performance. We were pleased; the board had good frequency response through 4 MHz. We measured the output power to be roughly 1 watt at 13.6 volts.

The output driver transistor has a single tier heat sink which got too hot for me to touch. For installations and conditions with restricted ventilation, such as a rocket on the pad waiting for liftoff, I recommend a larger heat sink with thermal grease. I used a Thermalloy Heatsink 2228B from Active Electronics for this application.

Small cameras are now becoming available at prices around that of a new HT. GLB has introduced a camera that Bill WB8ELK had at Dayton 1990 in the *ATVQ* booth. Although just black and white, the image quality was very good, the low light sensitivity was excellent, and the size and weight were ideal for rocketry.

Availability Of Parts and Software

I have decided to make available some of the electronics and hardware to build a refined version of *Argus IV.* For more information, contact High Technology Flight, a division of RP Industries, 1450 Jeffery St., Ypsilanti MI 48198-6319. Tel. (313) 482-2670. On-line BBS (300/1200 baud) (313) 482-2657.

The TXA5, TXA5-RC and FMA5-E are available from PC Electronics, 2522 Paxson Lane, Arcadia CA 91007-8537. Tel. (818) 447-4565.

You can obtain Thermalloy Heatsinks, SMB connectors, and other electronics parts from Active Electronics, 133 Flanders, Road Westborough MA 01581. Tel. (800) 677-8899. SMB connectors and other electronics are also available from Digi-Key, 701 Brooks Ave., South Thief River Falls MN 56701-0677 and Motorola Freeware BBS 300/1200/2400 baud, (512) 891-3733. ■

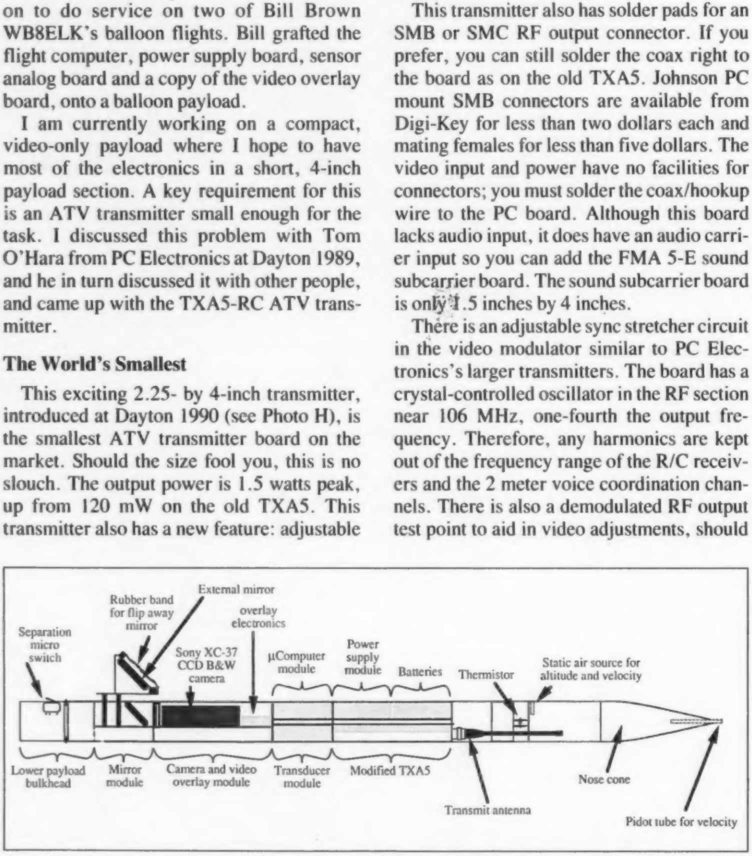

Figure 3. Block diagram of Argus IV ATV Rocket.

Number 17 on your Feedback card

R/C Helicopter ATV

Making ATV history.

by Juan Rivera WA6HTP

For most of the past year I have been learning to fly radio controlled model helicopters. It's a challenging hobby, and it appeals to me as a ham and pilot of full-size helicopters. Today's R/C models, especially helicopters, are extremely sophisticated mechanical marvels capable of amazing feats of aerial dexterity, and they're loaded with some very fancy electronics. They have to be!

Helicopter Aerodynamics

You see, as the pitch of a helicopter's main rotor blades is increased, not only does lift increase, but drag increases as well. This requires more power from the motor, and the throttle must be advanced to maintain rotor rpm. When power is increased, torque also increases. The torque reaction will tend to yaw the helicopter in the opposite direction from the direction of the main rotor rotation. To compensate, the pilot must increase the pitch of the tail rotor blades. This is one of the most challenging aspects of flying a full-size helicopter.

Any change in one control requires immediate corresponding adjustments in several others. And if that weren't enough, a helicopter is aerodynamically unstable. That's why a pilot's hands and feet are in constant use. You'll never see a helicopter with a hand microphone in it. A helicopter pilot can't let go of the controls long enough to reach for it!

Taming the Beast

R/C model helicopters are capable of amazingly quick movements due to their small size, and manually controlling all these things can be a real handful, especially since the pilot does not have the luxury of looking out the front windshield, and can't use his feet. To overcome this problem, three channels—main rotor pitch, throttle, and tail rotor pitch—are electronically mixed in a helicopter R/C radio system. When the main rotor pitch is changed, the throttle and the tail rotor pitch are automatically adjusted according to mixing curves which are entered and stored in the R/C transmitter.

In addition, most R/C helicopters use a rate gyro to help stabilize them. When the helicopter yaws, the gyro feeds an error signal proportional to the yaw rate to the tail rotor channel. This error signal is mixed with the normal control input and immediately adjusts the tail rotor pitch to help keep the helicopter pointed in the direction the pilot intends. These features make flying much easier.

Helicopter R/C Radios

Photo. The six-foot long, 11.5 pound helicopter can go over 60 mph in three dimensions.

To remote control a helicopter, you need a minimum of five channels. My radio system uses pulse code modulation (PCM) and transmits in the 6 meter band. I use seven channels for the following: roll axis, pitch axis, throttle, tail rotor pitch (yaw axis), rate gyro sensitivity HI/LOW, main rotor pitch, and unused ON/OFF function.

The more common radios use pulse position modulation in which the position of a control varies the position of a pulse within the transmitted data frame. With PCM, a digital word is transmitted which defines each channel's value in binary. In my system the word contains 10 bits, which resolves to 1024 possible positions of the servo. With a total control movement of only an inch or so, that's pretty tight control! As an added advantage, this method allows the application of digital error checking and correction techniques.

The R/C transmitter downloads preset fail-safe settings for all channels at regular intervals which are stored on board the receiver's microprocessor. The receiver constantly compares incoming data with previous data. Any gross change indicates an error condition. Should this happen, all the servos will either maintain their last valid settings or slave to their fail-safe positions, depending on how the R/C system has been configured. This feature allows the helicopter to "fly through" areas of low signal strength or interference.

To appreciate the level of sophistication in current R/C equipment, consider this: My receiver is constructed almost entirely using surface mount technology and weighs only 1.3 ounces. It is a dual-conversion superhet with both ceramic and crystal filtering, dual AGCs, and internal voltage regulation. This type of system is not only technically advanced, it's also very reliable and robust.

Sophisticated Aircraft

My helicopter kit is manufactured in Germany by a company called Schluter. The helicopter itself, almost identical in construction to its full-size cousin, is an absolute marvel of mechanically precise components and composite materials. The six-foot long, 11.5-pound helicopter is powered by a two-horsepower motor and can fly like the wind. Good pilots can perform every mind-boggling aerobatic maneuver imaginable, including hovering in inverted position.

So here we have a machine that can move effortlessly and precisely through the air at any speed from zero to over 60 mph in three dimensions. And it can easily lift several pounds, limited only by the pilot's ability to see and control it.

Airborne Amateur Television

Once I mastered the basics of flying my helicopter, it didn't take me too long to think of putting a TV camera on board. I ruled out carrying a miniature camcorder for two reasons. First, it has been tried without much success. The vibration and g-forces in that kind of environment are high, and the weight of even the lightest camcorder is a problem. A VCR's tape path and head-to-tape penetration must be maintained precisely for it to record properly, which is difficult to do in the presence of vibration and acceleration. The second, but most important, reason is that I wanted immediate gratification.

Looking at a tape is not as much fun as watching a live picture. (Only the spectators get to watch since the pilot must keep his eyes on the aircraft at all times.) Also, inadvertent and unexpected ground contact can sometimes occur, even when you have reflexes like a young mongoose, and mashing a camcorder into the ground could get expensive. Nope. It had to be a live picture!

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CH-5 Rate gyro sensitivity
CH-6 Collective pitch
CH-7 TV transmiter ON/OFF

-= TELEVISION SYSTEM =-

TRANSMITTER: 1.0 Watts P.E.P. AM
FREQUENCY: 426.25 MHz
CAMERA: NTSC Color
PICKUP: SOLID STATE CCD
RESOLUTION: 250,000 PIXELS
LENS: f=15mm, F1.6

-= STABILITY AUGMENTATION SYSTEM =-

A stabilizing bar is fitted to the main rotor control linkage such that its motion will produce a stabilizing cyclic pitch input if it is disturbed. The bar is fitted with weights as well as small airfoils and acts as a gyroscope. In addition an electric rate gyro produces a signal proportional to yaw rate which is injected into the remote control system and adjusts the tail rotor pitch in a direction to counteract the yaw.

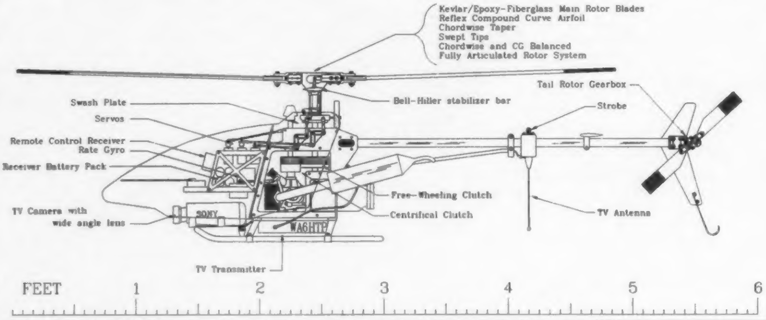

Figure. The WA6HTP Live Television Helicopter.

Selecting a transmitter was easy. One look in the radio amateur handbook convinced me that it would be simpler to purchase one ready made than to build one. I decided on a one-watt 450 MHz transmitter from PC Electronics. It also has an audio subcarrier.

For my camera, a friend loaned me a very small Sony HVM-322Q monochrome designed for surveillance use. About the size of a pack of cigarettes, it weighs 6.7 ounces and draws 0.9 watts. Surprisingly, it uses a half-inch Saticon tube rather than a CCD. And it has an auto iris and built-in microphone!

I mounted a quarter-wave whip straight down on the tail boom and trimmed it for minimum reflected power. TNC connectors and miniature Teflon™ coax keep the weight down.

After building a mount for the camera and a transmitter enclosure of 1/16-inch plywood lined with copper foil, I was ready for my first test. It was far from a success. The TV transmitter's RF got into the camera, and worse, the R/C receiver went completely crazy. When you have a machine swinging a five-foot blade at over 250 mph, loss of control is unthinkable. I had to completely eliminate RFI problems from the radio control link or it would have been too dangerous to fly. It looked like I would have to actually put some effort into the project if I was to succeed.

Beginning Again

As the helicopter kit comes from the factory, there is a metal control rod that travels from the tail rotor all the way to the servo tray in the nose. This rod was close to the TV antenna as well as the R/C receiver, and looked like a major suspect. In addition, the R/C receiver came with a long-wire antenna which extended out the back and was hooked to the tail with a rubber band. The rod was very close to the TV antenna. Obviously, both had to go.

I replaced the metal control rod with one made of nylon, and went to a short base-loaded R/C antenna which mounts in the nose and points forward. That gave me the benefit of cross-polarization and physical isolation. Then I set about bonding every metal part to the main frame of the helicopter.

Shielding—More is Better

I also modified the foil-lined plywood enclosure by adding RF suppression filters to all lines entering or leaving. They are rated at a minimum of 55 dB of attenuation at 450 MHz. These four steps completely cured the R/C receiver's RFI problems. However, the camera was still being clobbered. RF radiation from the antenna was the culprit. When transmitting into a dummy load, everything was fine.

By wrapping the camera like a mummy with adhesive-backed aluminum foil, I was able to greatly reduce the problem, but I couldn't completely eliminate it. I discovered that RF was actually getting in through the lens optics. The signal levels on the face of the tube are infinitesimal, and it doesn't take much RF to make its way into the video preamp. As a last resort, I added a piece of thin-mesh copper screen right over the lens. Finally, I had a picture with only a small amount of interference.

ATV Historical Event

At this point, I may have made amateur television history. I believe I'm the first person to actually crash an R/C helicopter right through an apple tree while transmitting a live picture. Branches, leaves, and pieces of apple flew everywhere. Whew!

I had just gone for a "personal best" altitude record while flying from my back yard. I had it up several hundred feet when I realized I didn't yet know how to fly well enough to have a prayer of a chance of getting it back in one piece. Talk about a sinking feeling! Well, at least I have a great tape to play at parties.

After becoming experienced with the system, I realized that one watt is much more power than needed. This exacerbates RFI problems and requires larger and heavier batteries than necessary. Since the transmitter is AM, dropping the power is not simple, since the modulator would have to be redesigned. PC Engineering also makes an 80 milliwatt transmitter so I immediately took the coward's way out and sent off for it. It didn't have an audio subcarrier, but I was tired of listening to the motor, anyway.

Having assured myself that television could reliably be transmitted from the helicopter, I decided to purchase a color camera. Using the 450 MHz handie-talkie, I tested several cameras for RFI susceptibility. CCD cameras turn out to be much less sensitive to RF than tube-types. Vibration-induced microphonics are also greatly reduced. The camera I chose was a Sony CCD-G1S. It has an auto iris, a tremendous illumination range, and great resolution. It's considerably bigger and heavier, weighing about one pound, but the helicopter had proven its ability to carry the weight easily. Meanwhile, I had managed to wipe out the 80 milliwatt transmitter so I returned to the one-watt version. This time the results were excellent! Flying at an altitude of several hundred feet, you can clearly see the helicopter's shadow as well as good detail of people on the ground.

Now I have a reliable and mature color TV system which I fly almost every weekend. It's a great crowd pleaser and a joy to play with. I use a small 8mm Sony video Walkman™ to tape each flight and display video on a larger nine-inch monitor for viewing at the site. And the unused seventh channel on the R/C system was put to use driving two solid state relays which control the TV system.

Future Images

Results have been so encouraging with this simple system that I am preparing to test-fly a miniature broadcast quality 2 GHz transmitter on loan from the manufacturer. I'll be running tests at KTVU-TV, where I am employed. We'll be using our existing 2 GHz electronic news gathering (ENG) equipment.

This will give us the ability to put the helicopter on the air live from just about anywhere within a radius of several hundred miles, using a system of mountaintop repeaters, as well as a mobile ENG repeater truck. That's something to anticipate! 73

Juan Rivera WA6HTP, 354 Marshall Drive, Walnut Creek CA 94598.

Number 18 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

As I am writing this column, the news reports that devastating tornadoes almost wiped out the downtown and surrounding area of Limon, Colorado, during the night (June 6/7). Since I grew up in a tornado belt in northeast Kansas, I feel very concerned for the residents of Limon.

One item in the report caught my ear: There were no communications in or out of the area until TV news teams from Denver, 70 miles to the northwest, arrived several hours later. I asked myself, "What about hams?" The closest repeater listed in The ARRL Repeater Directory *was at least 60 miles away, quite a haul for an HT or mobile unless the repeater is on one of the 10–14,000-foot mountains west of Denver and Colorado Springs.*

Not that there should be more repeaters in each community; I am just wondering if any hams provided other sources of communications, such as HF or packet. I also wonder if community leaders had emergency plans for such circumstances, and whether local hams were involved in the planning and implementation of the plans.

This is just one instance of many disasters reported around the world daily. Were they prepared? Are we prepared? If we aren't ready or don't know, are we willing to do something about it? Get involved, help yourself, and help your fellow man. The next disaster may be yours.

And now on to the many happenings around the world.—Arnie N1BAC

Roundup

Egypt From *Egyptian Echos.* In 1986 Egyptian radio amateurs teamed up and formed a society for the first time in about 50 years. Egypt Amateur Radio Society (EARS) is now five years old, and growing! It is a giant step towards reviving a civilized, sophisticated and scientific hobby about to vanish in Egypt.

Egypt was once the only country in all Africa and the Middle East with a radio amateur society. Egyptians had even practiced amateur radio before some European countries did. But the situation today is deplorable. In a country with 55 million inhabitants, there are only about 25 radio amateurs.

It is a shame that a country of our size and stature has only this insignificant number of amateurs, while countries new to the hobby have thousands of amateurs. Let us look at the statistics to dramatize the issue. Malta has 352 amateurs, Cyprus 530, and Israel 1350—the small populations of these countries notwithstanding.

Why are there so few amateurs in Egypt? Well, the problem is twofold. First, there are bureaucratic hurdles that must be removed if the hobby is to thrive in Egypt once again. Second, we cannot vindicate ourselves, Egyptian amateurs, of our role in the build-up of the current situation.

Contrary to public belief, the solution to the first part of the problem is easy. We can meet with senior officials and they will definitely take all actions needed to straighten up things. It is always the rule that the higher you go up the governmental hierarchy, where visions become broader, the easier issues can be resolved.

The bigger part of the problem, however, rests with us—Egyptian amateurs. It is our duty to go out and inform the masses of this great hobby. This newsletter is intended for that purpose, but it cannot, and should not, be our only effort towards educating the public. We should do our best to recruit new amateurs, if we really love this great country of ours. We can go to universities, high schools, social clubs, and wherever potential amateurs may be found, and hold seminars on amateur radio. We can contact newspapers, magazines, and radio and TV stations to report our problems and reach out to the large sectors of Egyptian youth. There is reason to believe that these channels of mass media will be more than happy to help us and carry our message.

Radio amateurs in the whole world are known to be nationalistic, and Egyptian amateurs should be no exception. So, let us roll up our sleeves and get to work. The task may be difficult, but here lies the challenge. And if we don't do it, who else will?

[How many of you readers can substitute your country's name in place of Egypt and have this article give truth to your situation? It hits the nail on the head: "If we don't do it, who else will?"—Arnie]

Egyptian Echos is a monthly newsletter (temporarily published bimonthly) of the Egypt Amateur Radio Society (EARS). It is free of charge; send an SASE to be put on the mailing list of the next issue. Send news, views, comments, and correspondence directly to the editor. Editor: Dr. Hamed Nassar SU1HN, PO Box 1578, Alf Maskan, Cairo, Egypt. Bitnet:nassar@egfrcuvx. AMTOR: SU1HN@NKDZ(ORG=14072 MHz).

Japan. From *The JARL News.* The Japan Amateur Radio League (JARL) proudly announces its Ham Fair '90, to be held at the New Hall (Shinkan) of the Tokyo International Trade Center at Harumi, Tokyo. The fair will run from Friday, August 24 through Sunday, August 26. Admission FOR ALL 3 DAYS will be 900 yen for adults and 400 yen for children under 15.

This fair, which last year attracted 59,000 visitors from 14 different countries, expects to welcome several local as well as foreign dignitaries, and we urge you to join us at this amazing event. Special commemoration station 8J1HAM will be operating from Ham Fair '90.

Another item from *The JARL Newsletter:* In order to improve measures for dealing with disasters more effectively, the Ministry of Posts and Telecommunications (MPT) made a plan to observe and research the actual state of disaster following the earthquake in San Francisco. To meet the request of the Ministry, JARL sent Director Yoshio Arisaka JA1HQG along as a member of the "Mobile Telecommunication Group" under the leadership of Mr. Kamei of the Ministry to research the extent of emergency communication by amateur radio.

The Mobile Telecommunications Group arrived in Washington, D.C., on January 31 and from there proceeded to New York and San Francisco. They visited the ARRL, and among other things observed actual, on-the-spot outstanding situations of emergency communication during the disaster, and a new communication system at FCC and AT&T.

[How many of our countries have sent hams to study emergency communication in other countries? Apparently Japan's MPT realizes that hams can make a difference in emergency situations.—Arnie]

South Africa From *The SARL Bulletin.* Following a petition against the introduction of a novice licence from individual radio amateurs, the Postmaster General (PMG) asked the South Africa Radio League (SARL) to table details of the proposal at the AGM. The draft document was discussed recently and the concept unanimously approved by the delegates present. Some branches asked that the introduction of a novice licence be expedited. These sentiments were conveyed to the PMG who assured the SARL that the matter was receiving priority attention. The draft regulations are currently at the legal department and are expected to be presented to the Minister for approval within the near future.

Other news: Reno Faber ZS6OF and Peter Strauss ZS6ET (*73* Hambassador) attended the IARU Region One meeting in Spain. This was the first time in six years that the SARL was represented.

Taiwan. From a letter from Frank Eskuchen, W9ZNY/BV: *From the Outside. . . Looking In.*

When the business brought me to Taiwan in 1970 to open a factory, the normal business problems kept me away from ham radio. Came 1973 and I met Tim Chen. Came 1974 and we erected his first beam, a 3-element, 20 meter high-gain, and thus starts my story.

About 10 years ago a typhoon rolled the beam and we replaced it with one of the same type. It is still in use today.

The China Radio Association, sponsor of club station BV2A/BV2B is to be honored and commended for its effort to broaden the base of ham radio in Taiwan. Through the years they have helped a succession of improvements in equipment, location, publicity, and with government relaxing the regulations, a fine overall ham atmosphere.

This letter could be filled with stories about Tim Chen, but that has been well said in magazines and radio journals. Enough that he is my best friend.

Let's look at what has happened here from an outsider's standpoint. (Hardly an outsider; I live here, pay taxes, and ride the "Daredevil Taxies.")

I vividly recall in 1974 when the association awarded me a beautiful plaque for assistance in installing the beam. I was filled with humility to think that this group was so appreciative of my small efforts. It was later shown to my radio club in Florida, not as my achievement, but as an indication of the style of members of the China Radio Association.

What has really changed the ham picture in Taiwan, and what are the effects locally and internationally? Tim has been the grinding force with his unselfish push for more operators and stations. With its new operators and stations, the ham world now looks on Taiwan as a friend of ham radio. This bulwark of friends is important to any nation. As one listens to ham radio, one can see that it is nonpolitical and non-economic. A vast improvement.

The opening of Taiwan ham radio to groups of operators from friendly nations to operate for a limited time, contacting other operators, was great. Ham operators around the world were anxious to work (talk to) a station in Taiwan; Tim tried gallantly for years to meet their demands. Many previously frustrated hams can now say, "I have worked Taiwan," and thank the government for permitting these expeditions. Perhaps the most dramatic change from an outsider's viewpoint is the recent ruling that a visiting ham may operate from a Taiwan station when the Taiwan operator is present.

With Taiwan an outstanding electronics exporter, many electronics experts and buyers, who are also hams, travel through Taiwan every day. The question "Can I operate?" can now be answered "Yes!" To the visiting radio amateur, Taiwan has moved into the Developed Nation status, as most nations permit this [third-party traffic].

Almost as important as the legal changes are the physical changes. For the visiting expeditions, a permanent, fine location was found on top of a 14-story building with wide areas on the roof for all types of antennas. It makes for outstanding signals and wide coverage. Through the kindness of one of the association members (Mr. Hu) the basic station is now in a penthouse atop a 12-story building, with a door to the roof and access to all antennas. What a signal output! Very impressive!

What else to say, and where to go? Like most projects of a worthwhile nature, this goodwill ham radio station did not come about by any single effort. The members of the China Radio Association and the Taiwan government are to be commended.

What for the future? Nothing is perfect, but it is hard to see any changes that would improve international relations at this time. With the liberation of the rules and cooperation of Taiwan operators, the occasional pressure to license foreigners is not important. From a local standpoint, the opening of 2 meter frequencies would be great. With such a large group of electronic experts in Taiwan, it could bring many to ham radio and would be a step for foreign hams.

In closing I want to convey my thanks to the CRA for their kindness, and remind them of these many accomplish-

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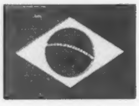
ments. They go far beyond the borders of Taiwan. Sometimes we are so close that we do not see. I see for all of you. *[Frank Eskuchen, W9ZNY/BV, %PO Box 30-547, Taipei, Taiwan, Republic of China.]*



BRAZIL

Carlos Vianna Carneiro PY1CC
Rua Afonso Pena 49/701-TIJUCA
20270 Rio de Janeiro-RJ
Brazil

PQ2—Tocantins— A New Brazilian State

Due to its continental dimensions, geographical characteristics, economic and political interests, and national needs, Brazil now and then creates new states by means of strategic divisions of its territory, to enhance desired development in some not-so-developed areas.

Tocantins State, the latest state created, is the result of the political and geographic division of Goias State, the northern part of which now forms an ample area right in the center of Brazil. For us radio amateurs, this means a new prefix, PQ2, and the excitement of hunting a new one for our files. Some lucky guys here, working for the airway companies, are starting a kind of DXpedition to Tocantins State whenever their planes land there, and heavy pileups and plenty of QSOs pay for their efforts.

Brazil now has 27 different prefixes for Classes A/B radio amateurs and 10 series from PU1 to PU0 for Class C beginners, 10 ZY series to the 10 Regions from 1 to 0 (islands included), and still several ZV-ZW-ZX and ZZ for special calls. Very special calls can go to usual contest winners, provided that they have been among the 5 first places in 5 international contests.

Keep an eye on Brazilian calls, you prefix hunters, for QSOing the whole Brazilian series! *[Carl sent a list of the prefixes and class information, but it is too lengthy to place in the column. Check for it on the 73 BBS in 73 International SIG as "Brazilian Callsigns." —Arnie]*

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
Negev MPO 85530
Israel
Packet: 4X1MK@4Z4SV

No More Banned Countries!!!

For the last 43 years since our country gained its independence, relations with our neighboring countries have been somewhat less than friendly, to say the least. This has been reflected by the general prohibition of amateur radio contacts with those countries not having signed a peace treaty with Israel. DXers going after a coveted spot in the DXCC honor roll have resorted to all kinds of devious means to secure QSLs at the risk of losing their licenses.

Now, after lobbying by the Israel Amateur Radio Club (IARC) the authorities have rescinded the ban, and there are no more out-of-bound countries.

Here is a translation of the historic document which was addressed to Mr. Joseph Obstfeld 4X6KJ, the chairman of the IARC on the 25th of March 1990: "We are happy to inform you that our office has agreed in principle to your request and has decided to cancel the prohibition, applying to Israeli radio amateurs, to contact the countries cited in Appendix 'C' to the conditions of the amateur radio station license (Algeria, United Arab Emirates, Bahrain, Tunisia, Jordan, Kuwait, Lebanon, Libya, Maurtania, Morocco, Sudan, Syria, Oman, Iraq, Saudia Arabia, Qatar, Popular Democratic Yemen and Republican Yemen *[The two Yemens are now one country.—Arnie]* The repeal will go into effect, beginning with the date of this letter and an announcement to the effect will be sent directly to all licensed radio amateurs . . . ."

This repeal of the banned countries list reflects the kind of thinking that we hope will lead us into an age of enlightenment. The media in Israel have taken keen interest in the move, although at first glance it would seem that the possibility of DX hunters being able to make some more countries should be no big deal to anyone. However, here is another channel of communications being opened to our neighbors, and it can only tide well for the future. Ham radio means people talking to people, and countries are, after all, people.

IARC Representatives Return from Spain

Peleg Lapid 4X1GP and Rod Roden 4X8RR are home after having represented the IARC at the International Amateur Radio Union (IARU) Region One convention at Torremolinos, Spain, attended by representatives from 47 countries. Some of the main topics dealt with were: presenting a united stand at the upcoming World Administrative Radio Conference (WARC), where there will be strong pressure put on our frequency bands; band plans; reducing the number of contests on the air; and electromagnetic compatibility of equipment.

After being nominated by the Hungarian delegation, Ron 4X8RR was elected Monitoring System Coordinator for IARU Region I.

It was announced that the Agency for the Exploitation of Space and the Institute for Space Research at Haifa's Technion University are at work planning an Israeli satellite with amateur radio aboard for educational purposes.

In the closing assembly, the session's chairman read out the official letter of the IARC chairman regarding the repealing of the banned countries list, and received overwhelming applause from the delegates!

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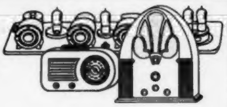

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

AUG 3–5

OKLAHOMA CITY OK Central Oklahoma Radio Amateurs will sponsor the 17th annual Ham Holiday which will also be the ARRL Oklahoma State Convention, at the Lincoln Plaza Convention Center. Doors open at 8 AM Saturday and Sunday and at 7 PM on Friday. Admission is $8 advance, $10 at the door. Flea Market tables are $7 in advance, $9 at the door. Banquet tickets are $8.50. Scholarship fund tickets are $2 each or 3 for $5. VE Exams. Talk-in on 147.03+ and 444.20+. (PL is 141.3). Send registration to *CORA, P.O. Box 95942, Oklahoma City OK 73143-5942.*

AUG 4

LANCASTER PA The Red Rose Repeater Association is sponsoring its annual Computer Fest at the McCaskey High School. Vendors 7 AM, public 9 AM–3 PM. Admission $4. Children under 14 free with a paying adult. Tailgating on first come basis (if weather permits), $5 per space. 8′ tables $22 each. 5 or 6′ tables $18 each. Tables resold unless occupied by 10 AM.Advance reservations and info: *James Linville, 399 Lampeter Road, Lancaster PA 17602. (717) 291–9050.* Please enclose a SASE. Talk-in on 147.015/.615.

AUG 4–5

JACKSONVILLE FL The Greater Jacksonville Amateur Radio & Computer Show will be held at the Prime Osborn Convention Center from 9 AM–5 PM Saturday and 9 AM–3 PM Sunday. Registration $5 at the door. Tables $12 for Saturday only or $15 for the weekend. Power at extra charge. For swap tables, contact *Wade Rhyne AJ4J, Box 11882, Jacksonville FL 32239.* For other information write *Greater Jacksonville Hamfest Assn., Box 10623, Jacksonville FL 32207.*

AUG 5

BERRYVILLE VA The 40th annual Winchester Hamfest, sponsored by the Shenandoah Valley ARC, will be held at the Clarke County Ruritan Fairgrounds, Rte. 7, from 7 AM–3 PM. Gate admission is $5; children under 12 and spouses free. Advance admission is $4 with SASE before July 15. Tailgaters and limited tables, $7. VE Exams at 9 AM in Cooley Elementray School, across from Fairgrounds. Talk-in on 146.22/.82 and 146.52 simplex. For further info contact *Walter Johnson WA4HVU, at (703) 667–1474* or write *SVARC, PO Box 139, Winchester VA 22601.*

CROOKED LAKE IN The 1st annual Land of Lakes Angola Hamfest will be held at the Steuben County 4-H Park from 6 AM–2 PM. Free parking. Camping available. Advance donation $3, $4 at the door. Table charge $5. Trunk sales $2. For tickets and info write: *Land of Lakes Angola Hamfest, PO Box 465, Fremont IN 46737.*

RANDOLPH OH The Portage ARC, Inc. will sponsor its fifth annual Hamfair at the Portage County Fairgrounds from 8 AM–4 PM. Tickets are $3 advance, $4 at the gate. Children under 12 free. Indoor tables $8 each, flea market spaces $3 each. Computer hobbyists welcome. Mobile check-in on 145.390–. Contact *Joanne Solak KJ3O/8, Portage ARC Inc., 9971 Diagonal Rd., Mantua OH 44255. (216) 274–8240.*

AUG 11

PARKERSBURG WV The Mid-Ohio Valley ARC will sponsor a Hamfest from 0800–1700 local time. Free parking. Admission $2. Talk-in: 146.145/.745, 146.37/.97, and 146.52 simplex. Contact *Ron Ferrell WD8RGZ (614) 423–5482* or *Bill WF8U (304) 485–7777.* Or write *MOVARC, 1810 Staunton Ave., Parkersburg WV 26101.*

RHINELANDER WI The 11th annual Rhinelander/Tomahawk Swapfest, co-sponsored by the Northwoods ARC, The Tomahawk Repeater Assoc., the Oneidea County ARES and the Rhinelander Repeater Assoc., will be held at the Rhinelander Ice Arena from 9 AM. Set up at 7 AM. Admission $1. Free tailgating. Auction at 1 PM. 3′ x 8′ tables can be reserved for $5 each. Talk-in on Rhinelander repeater 146.34/.94, Tomahawk repeaters 144.83/145.43 and 223.76/222.16. Contact *Leonard Bauman K9RMN, 804 Lincoln St., Rhinelander WI 54501. (715) 369–3296 or (715) 369–5564.*

PETOSKEY MI The Straits Area ARC (affiliated with ARRL Club #1083), will sponsor its 15th annual Swap Shop from 8 AM–1 PM at the Fairground's 4H building. Admission $2.50 at the door. Tables $3 for 8′. Splits allowed. Self-contained RV parking on grounds. Talk-in: 146.08/.68 or 52. Contact *Irene N8HBT, (616) 539–8986* or *Clark KA8TIL (616) 582–6455.*

SWANZEY NH The QSO Wireless Assoc. and the MRHS Band will co-sponsor an outdoor Ham Radio and Electronic Fleamarket at the Monadnock Regional High School from 8 AM–4 PM. Set up at 7 AM. Donations $1 buyers, $4 sellers. VE Exams at 10 AM. Talk-in on 147.375+ Keene Machine, and 146.52 simplex. Contact *John Goodwin N1BAP, RFD1 Box 408C, Keene NH 03431. (603) 352–9153.*

ESSEX JUNCTION VT The Burlington ARC will sponsor a Hamfest at the Champlain Valley Fairgrounds from 8 AM–5 PM. Admission $4. Tables $5 on a first come basis. VE Exams at 2 PM. Talk-in: 146.94/–600 or 146.61/–600. For info: *Tom Taylor N1EXY, (802) 893–4834* or *Joe Tymecki N1DMP, (802) 893–6458.*

AUG 11–12

AMARILLO TX The Panhandle ARC will hold 16th Annual Golden Spread Hamfest which will be held at the Amarillo Civic Center Exhibit Hall in association with the Amarillo Chamber of Commerce from 9 AM–4 PM both days. Pre-registration $6, $7 at the door. Extra chances $2. Tables $5. Talk-in: 146.67 W5WX repeater. Contact *Golden Spread Hamfest, PO Box 1524, Amarillo TX 79105-1524.*

AUG 12

VALPARAISO IN The Porter County ARC will hold its 9th annual Hamfest at the Porter County Fair Grounds starting at 7 AM. Adults $5, under 12 free. Table, chairs and electricity available indoors only. Overnight camping. Talk-in: 146.775/–6 or 52. Contact *Carl KA9TAD, (219) 759–4224* or send SASE to: *PCARC, PO Box 1782, Valparaiso IN 46384.*

WARRINGTON PA The Mid-Atlantic ARC's Hamfest '90 will be at the Bucks County Drive-In Theater, on US 611. Buyers admitted at 8 AM, tailgate set up 7 AM. General admission $3. Tailgate space $2. Talk-in: 147.06/R and 146.52 simplex. For info call *Al Maslin W3DZI, (215) 446-4936.*

GEORGETOWN KY The ARRL Central Kentucky Hamfest, sponsored by the Bluegrass ARS, Inc., will be held from 8 AM–4 PM at the Scott County High School. Outside flea market space free with paid admission for each person over 12 years of age. Tickets $5 in advance, $6 at the gate. Commercial vendors' tables are $12 each if prepaid before August 1. $15 each after August 1. For info or tickets send SASE to *Bill DeVore N4DIT, 112 Brigadoon Parkway, Lexington KY 40517*, or call evenings *(606) 273–8345.*

ST. CLOUD MN The St. Cloud ARC Hamfest will be held at the Whitney Senior Center. Tickets $3. Extra ticket $2. Talk-in: 34/94 primary, 615/015 secondary. Contact *SCARC, Box 141, St. Cloud MN 56302.*

GEORGETOWN KY The Central Kentucky ARRL Hamfest, sponsored by the Bluegrass ARS, Inc., will be at the Scott County High School from 8 AM–4 PM. Advance tickets $5, $6 at the gate. Commercial exhibits in air conditioned facilities. Outside flea market space fee with paid admission for each person manning the display. For info or tickets, SASE to *Bill DeVore N4DIT, 112 Brigadoon Parkway, Lexington KY 40517.*

AUG 13

BOULDER CO The Boulder VE Team will be testing at the American Legion beginning at 7 PM. For info and to pre-register, call *Barbara McClune N0BWS, (303) 530–1872.*

AUG 17

VERONA NY The Madison-Oneida ARC holds VE Exams the third Friday of every month at the Madison-Oneida BOCES, beginning at 7 PM. Talk-in on 145.37. Contact *Leonard Popyack WF2V. (315) 853–8974, or radio 146.79, 145.37, WF2V @ WA2TVE, or POPYACK@TOPS20.RADC.AF.MIL.*

AUG 19

GEORGETOWN DE The Delmarva Hamfest will be held at the Delaware Tech. Comm. Coll. from 8 AM to 4 PM. Inside tables $5. Tailgate $3. Talk-in: 147.075 and 224.84. For table reservations and info write: *Delmarva Hamfest, Route 2 Box 244G, Georgetown DE 19947.*

CAMBRIDGE MA The MIT Electronics Research Soc. and the MIT Radio Soc. will hold a Tailgate Electronics/Computer/Amateur Radio Flea Market form 9 AM–2 PM at Albany and Main Streets. Free off-street parking. Covered tailgate area available for all sellers, rain or shine. Admission $1.50 Sellers $5 in advance, $8 per space at the gate. Includes 1 admission. Set up at 7 AM. Contact *(617) 253–3776.* Mail advance reservations before the 5th to *W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*

AUG 25

TOPEKA KS The Washburn RC (Washburn Univ.) will sponsor 'FEST 1990 at the Washburn Univ. in Whiting Fieldhouse from 10 AM–3 PM. Set up at 9 AM. Admission $3 advance, $4 at the door. Swap tables $5 in advance, $7 at the door. Children under 10 free if with an adult. Talk-in: 146.955–. Contact: *Washburn Radio Club c/o Rob Nall WV/0S, 2612 SW Arrowhead Rd., Topeka KS 66614.* Please include an SASE. Make checks payable to Washburn Univ.

ITHACA NY The Tompkins County ARC will sponsor the Finger Lakes Hamfest at the New York State Armory. Handicapped accessible. Tickets $3 in advance, $4 at the gate. Tailgate $2. Indoor space call for price. Under 18 free. Daycare available ages 2 up. For tickets or table info send SASE to: *T.C.A.R.C., PO Box 4144, Ithaca NY 14852-4144* or call *Larry King N2GFW at (607) 347–4313.*

AUG 25–26

DAYTON OH The Dayton Microcomputer Asso., Inc. will sponsor Computerfest '90 at the Hara Conference & Exhibition Center. Free parking. Admission is $3 each day. Children under 12 free when accompanied by an adult. For info call *(513) 263-FEST.* For updates call our BBS at *(513) 293–1754. 300/1200/2400, 8, 1, none.*

MARYSVILLE OH The Union County ARC will sponsor the 15th annual Marysville Hamfest at the Fairgrounds Saturday evening and Sunday. Free entertainment on Saturday evening. Free overnight camping. Admission is $3 advance or $4 at the gate. For info contact *Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040. (513) 644-0468.*

AUG 26

MULLICA HILL NJ The Gloucester County ARC will sponsor a Hamfest at the Gloucester County 4-H Fairgrounds from 8 AM–4 PM. Set up at 6 AM. Admission $3.50 advance, $4 at the gate. Tailgate $6 with electricity, $5 without. Ticket needed with tailgate space. VE Exams 9 AM. Talk-in: 147.18/.78, 223.06, 224.66 repeater, 146.52 simplex starting at 6 AM. Send SASE and check to: *GCARC Hamfest, PO Box 370, Pitman NJ 08071.* For info call *KE2NY, (609) 933–0213* or club phone *(609) 478–4738* and leave message.

LEBANON TN The Lebanon Hamfest, sponsored by the Short Mountain Repeater Club, will be at the Cedars of Lebanon State Park, US Highway 231, from 7 AM–3 PM. Outdoor facilities only. Exhibitors bring your own tables. Space available on a first come basis. Talk-in: 146.31/.91. Contact *Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211. (615) 832–3215.*

SPECIAL EVENT STATIONS

JUL 20–AUG 5

SEATTLE WA The Fort Lewis Amateur Radio Activity, W2USA, will be the official station for the Goodwill Games. Operation will be on the top 15 kHz of the General portion of the 80, 40, 20, 15, and 18 meter bands. 10 meter operation will be in the Novice/Tech portion of the band. For a QSL send a #10 SASE to: *Commander, I Corps and Fort Lewis, AFZH-PAM-H, Ft. Lewis WA 98433-5000.*

AUG 1–6

SAN BENITO TX The San Benito ARC will operate WA2VJL to celebrate the 2nd annual Dog Days of Summer. Exchange local weather conditions and general weather facts of your QTH. Frequencies: 21.350, 28.325 SSB; 14.030 CW (CQ DOG) with operation from 1900UTC–0300UTC. For unfolded certificate send 9½ x 11 size SASE and QSL card to: *San Benito ARC, ARRL #2247 SSC, Attn: Brenda V. Ryan-QSL Mgr., PO Box 1382, San Benito TX 78586.*

AUG 3–5

WIESBADEN WEST GERMANY The Wiesbaden ARC will sponsor DA1WA on the 1st annual DX-pedition to the Castle Frankenstein from Friday 2000UTC–1200UTC Sunday. Frequencies: 10-80m SSB and CW, using 100 watts and wire antennas. A special QSL card is planned. *QSL via the bureau or direct to DJ0PU.*

AUG 4

MIAMI FL The Active Duty Coast Guard and other guest operators will operate AB4MT from the U.S. Coast Guard Communication Station to celebrate the 200th Anniversary of the U.S. Coast Guard from 0000Z–2400Z. Frequencies: .060 KHz on 7, 14, 21, and 28 MHz CW; 7260, 14260, 21350, 28450 KHz SSB. A Special Edition "Collectors Item" QSL card will be issued for all 2-way contacts, and include a pamphlet of interesting CG info. QSL to *USCG Communication Station Miami FL—NMA, 16001 SW 117th Ave., Miami FL 33177-1699*, or via AB4MT CBA.

AUG 4–5

TITUSVILLE PA The Oil Creek Valley Radio Soc. will operate N3GBH to commemorate the fifth year of operation of the Oil Creek & Titusville Railroad, onsite at the historic Perry Street railroad station Saturday from 1300UTC–1900 UTC Sunday. Frequencies: CW: Novice portion of 80, 40 and 15 meters; SSB: Novice portion of 10 and General portion of 15, 20, 40 and 80 meters. For special photo QSL, cancelled from the only operating railway post office car in the country, send QSL and #10 SASE to *Bill Lyons, Sr. N3GBH, 427 South Drake St., Titusville PA 16354.*

BARNEGAT LIGHT NJ The Old Barney ARC will operate W2OB to commemorate National Lighthouse Day. Frequencies: CW: 3.540, 7.040, 14.040, 21.040, 28.040; SSB: 3.900, 7.275, 14.290, 21.390, 28.390. FM: 146.835 rpt, 146.52. For special QSL, send SASE to *Joseph Fleishinger Sr. NU2F, 75 Joshua Dr., Manahawkin NJ 08050.*

BENTON KY The Marshall County ARA will operate a Special Event Station to celebrate the Steam and Gas Show at Forgotten Past Amusement Park. Frequencies: 20 kHz above the lower phone portion of the General band edge and 28.367± for QRM, on the Novice portion. For certificate send SASE to: *MCARA, PO Box 534, Benton KY 42025.*

AUG 5

FISHERS ISLAND SOUND NY Tri-City ARC will mount its 6th annual DXpedition to Flat Hammock Island and will operate KA1BB from 1300Z–2000Z. Frequencies: Lower 20 kHz of General class phone and CW bands—10, 15, 20 and 40 meters, the center of 10 M Novice band, and the 2 M SSB band. QSL with letter size SASE via: *Tri-City ARC, Box 686, Groton CT 06340.*

AUG 6–11

CUYAHOGA FALLS OH The Cuyahoga Falls ARC will sponsor AA8AA for the 53rd running of the All-American Soap Box Derby, Monday–Friday from 2200Z–0300Z; Saturday from 1100Z–2000Z. Frequencies: 3.860, 14.240, 28.420. For certificate send a large SASE, by 20 Sept. 1990, to: *CFARC, Attn: Mark McMahon KE8XQ, Box 614, Cuyahoga Falls OH 44222.*

AUG 15–17

BRIDGEWATER NJ The Somerset County Office of Emergency Management will operate WC2ADK Aug. 15–17, from 1400Z–0100Z each day, to promote Amateur Radio, R.A.C.E.S, and Public Service at the annual 4-H Fair. Frequencies: Lower 25 kHz of General 80–10 meters and 10 M Novice; visitors on 145.32 simplex. Send QSL and SASE to *Somerset County OEM/4H, PO Box 3000, Somerville NJ 08876.*

AUG 18–19

HAGERSTOWN MD The Antietam Radio Assoc. will sponsor the all-new Maryland/DC QSO Party Aug. 18th from 1600Z–2359Z Aug. 19th. Logs should be mailed to the contest chairman by Sept. 10, 1990. For info contact: *WA3EOP, Contest Chairman, Antietam Radio Association, PO Box 52, Hagerstown MD 21741*. Mail logs to: *Antietam Radio Assoc., PO Box 52, Hagerstown MD 21741.*

AUG 18–19

ENGLEWOOD NJ The Englewood ARA, Inc. invites all amateurs the world over to take part in the 31st annual New Jersey QSO Party from 2000UTC Aug 18th–0700UTC Aug 19 and from 1300UTC Aug 19–0200UTC Aug 20. Please send all inquiries to:*Englewood ARA, Inc., PO Box 528, Englewood NJ 07631-0528.*

AUG 19–26

DETROIT MI The Jewish Community Center Radio Club will operate Station K8PBQ during the 1990 North American Maccabi Youth Games from 1400UTC–0100UTC. Frequencies: CW: +45 kHz from the bottom end of all bands. Novices: 3725, 7125 & 21.125 MHz. Phone: 3910, 7280, 14.335, 21.380 & 28.580 MHz. Special QSLs and certificates. Certificates for contacts on both CW and phone. Send regular SASE for QSL or 9" x 12" SASE for certificate to: *JCCRC—K8PBQ, 6600 West Maple Rd., West Bloomfield MI 48322.*

AUG 25

WICHITA FALLS TX The Wichita County ARES HF Group will operate WB5PHM from 0700Z–2300Z at the Memorial Stadium, site of the start/finish line for the Hotter-N-Hell-Hundred bicycle ride/race. Operation will be on the General 40 and 80 meter phone bands and Novice thru General 10 meters. For certificate send QSO number and 9" x 12" SASE to *Herb Sleeper WB5PHM, 4705 James Ct, Wichita Falls TX 76308.*

AUG 26

BEDFORD UNITED KINGDOM The Bedford and District ARC in England will operate Station GB0JDC at the Jaguar Drivers Club, Old Warden Airfield. It is intended to operate on 2 M, 6 M and as many of the HF bands as possible. Contact *L.R. Smith G1ZOJ, 1 Perring Close, Sharnbrook, Bedford UK.*

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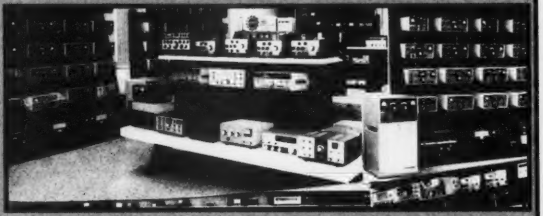

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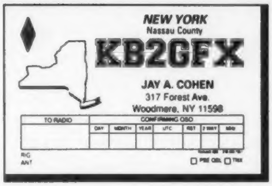

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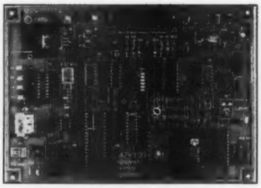

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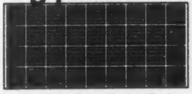

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73 Review

by Dick Goodman WA3USG

The Kansas City Tracker

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Tel. (609) 751-1018
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Let the computer do the work while you do the operating.

About two years ago, I became interested in space communications, and in working OSCAR 13 in particular. I already had most of the necessary equipment, including an old ICOM IC-211 2 meter all-mode rig and a Microwave Modules 432 MHZ transverter. All I lacked were the uplink and downlink antennas. I considered building these but finally opted to purchase Hy-Gain's OSCAR array. Both the 2 meter and 70cm antennas were well-built and came highly recommended. Needing something to drive these in Az-El, I purchased an Alliance HD-73 rotor for azimuth and a used Kenpro G-500 elevation rotor at a hamfest.

This kept me happy for about 2 years. I have made approximately 250 QSOs through both OSCARs 10 and 13, and my simple equipment performed quite well! These satellites are in highly elliptical orbits; once you point your antennas at them, sometimes you don't have to make adjustments for hours.

Then came the Microsats! These little birds are in circular orbits only a few hundred miles up. A complete pass takes a maximum of twenty minutes, compared to nine or 10 hours for the OSCAR 10 and 13. Antenna pointing requirements for these satellites are much more demanding than for the Phase III birds.

Several articles on receiving techniques recommended omni-directional antennas, such as the J-Pole, dipoles, and even verticals. I tried a couple of configurations, and I was able to receive acceptable signal levels but there was a lot of QSB. Using my IBM clone and Instant Track software, I could manually keep my OSCAR array pointed at the Microsats and receive signals on the order of 10 to 60 dB over S-9. Unfortunately, keeping the antennas pointed was a full-time job during the pass, and left little time for operating. If only there were a way for the computer to actually control the antennas!

The KCT Package

Well, there is! L.L. Grace, Inc., a small company in Voorhees, New Jersey, manufactures a product called the "Kansas City Tracker."

The Kansas City Tracker, or KCT, is a complete system for pointing your antenna array (both in azimuth and elevation) at any body orbiting the Earth, such as satellites, the space shuttle, and even the moon. It will track your antennas for the entire duration of the pass with an accuracy of ±5 degrees.

The system consists of an 8-bit card that plugs into an IBM clone (mine is a 12 MHz 80286 machine), installation and calibration software, a software driver for the three popular satellite tracking programs (QuikTrak, GRAFTRAK, and Instant Track), and an extremely well-written installation and user's manual. I received my Kansas City Tracker by UPS about a week after I placed the order.

KCT Options

There are two options that you may wish to consider before placing your order. The first is the Kansas City Tuner, which will automatically tune your rig to compensate for Doppler shift during a satellite pass. This $79 option will compensate for Doppler with rigs that have a computer interface or "mike click" tuning (e.g., the TS-711/811). You may think you don't need this now, but IT CANNOT BE INSTALLED LATER. You may buy either of two boards, one with the option and one without. I ordered the board with the tuner, but I haven't used this option yet.

The second option, which you will need if you're using any rotor other than the Yaesu/Kenpro 5400/5600, is the Rotor Interface Option for $30. It consists of 300 mA open collector relay drivers for using the KCT with virtually any antenna rotor that will return an analog voltage level proportional to the rotor position.

The cost of both options plus the basic package is about $305, including shipping.

Installing Relays

The first thing I did upon receiving my KCT was to modify the rotor control boxes for my HD-73 and G-500 elevation rotor. Both control boxes need to have relays, which you can find at Radio Shack. Two relays need to be installed in your azimuth rotor box with the normally open contacts in parallel with the left and right actuator switch contacts. The KCT will actuate these relays to drive the antennas left or right, respectively (and you'll still have complete manual control of your antennas).

The voltage from the position-sensing pot must also be brought out to the KCT through an adjustable voltage divider built from a couple of Radio Shack components. These are installed in the rotor control boxes (this modification is detailed very clearly in the KCT manual). The HD-73 needed some minor changes for these modifications, but they were also covered completely in the manual.

The G-500 elevation rotor control box only needed the relays installed and the position voltage brought out via the divider. No other modifications were necessary to this control box. Total time to modify both control boxes was about one hour. It took another hour to make the cables that go from the rotor control boxes to the connector that plugs into the KCT board (a standard DB-25 supplied with KCT).

Installing the Interface Card

This card occupies four consecutive addresses, starting at the address specified on the card's DIP switches. Mine worked fine with the default address 3E0. If you have an address conflict, you can change to the I/O address of this device. You may also choose the interrupt vector that the KCT uses. The default worked fine with mine (incidentally, my computer is filled with option cards and I experienced no conflicts with either addressing or interrupts). You may change the interrupt level at anytime via the keyboard.

The card may now be installed in any slot in the computer. The installation and calibration software should now be run. This is also clearly documented in the KCT manual, and easily viewed on screen, menu-driven from the computer.

During this process, you will have to adjust the voltage dividers that you installed in the rotor control boxes, so it is best if you leave them accessible until this step is complete. This procedure will tailor the KCT system to your rotor configuration. You can specify what the maximum allowable elevation for your antenna will be.

The KCT system will also "learn" where your stops are and will avoid driving your rotor into them. Once the installation program is complete, you may practice driving the antennas around with the Status Pop-Up program. This is a TSR (Terminate-and-Stay-Resident) program that may be called from within any other nongraphic application by simply pressing ALT and O. A window will "Pop Up," displaying current antenna positions, and allow you to command the antennas in both azimuth and elevation.

Satellite Tracking Software

Also supplied with the KCT package is the software driver for AMSAT's QuikTrak and the other two satellite tracking programs. The programs themselves are not supplied with the

KCT, but you may order them from the AMSAT Software Exchange, PO Box 27, Washington DC 20044. You may also order QuikTrak from L.L. Grace for $80. In order for the KCT to track satellites, one of these programs is necessary. Operating instructions for QuikTrak are included in the KCT manual.

I use Instant Track, which the KCT manual doesn't mention, but the Instant Track manual provides detailed instructions on how to get the KCT operating with it. It took me all of 10 minutes from the time I had the installation and calibration of the KCT complete, to get it working flawlessly with Instant Track!

I track the satellites exactly the same way that I did before I got the KCT. I use Instant Track to see when the birds are coming over the horizon. When the computer indicates that the satellite is up, I simply press "R" on the keyboard and the KCT takes over. After you get the KCT tracking, you can leave the satellite program and use the computer for anything else you want. The KCT driver and tracking software will run in the background and keep both azimuth and elevation antennas right on target for the whole pass. For the Microsats, I load my packet program and QSO via LUSAT or PACSAT while my computer and KCT do their thing.

Earth-Moon-Earth Applications

As well as tracking satellites, the KCT used with Instant Track will keep your antennas pointed at the moon for EME applications. Also supplied with the KCT is an antenna pointing program that will allow keyboard control of your array by simply entering the callsign of the station with whom you want to communicate.

The KCT software will announce, automatically or on request, antenna headings and any KCT error conditions (such as a stalled rotor) in Morse code. Speed and spacing are adjustable. This feature would be excellent for blind amateurs.

Finally, one of the programs included with the KCT will drive your antennas to a specific heading, wait a user-selectable length of time, then drive to another heading. This may be repeated as often as desired, with an unlimited number of combinations. As suggested in the KCT manual, this would be excellent for unattended forwarding of packets to stations too distant to connect with via omni-directional antennas. My hat is off to L.L. Grace. They have created a super, high tech, extremely reliable product!

One night while I was on OSCAR 13, Sandy N3ECF, my XYL, needed to access the computer network where she works via modem. I ensured that the KCT was tracking AO-13, exited the Instant Track program, and loaded the telecommunications software. While I made contacts for two hours, she happily ignored me and logged into her network. Meanwhile the computer kept my antennas pointed at a speck in the sky 36,000 km away. Tell this to a ham back in the 1950s . . . we've come a long way. 73

You may contact Dick Goodman WA3USG at 199 Maple Lane, Mechanicsburg PA 17055.

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No-Code: Making it Work

As I think I made clear last month, I am among those who feel that creating a code-free entry level license class is essential to the future viability of the nation's scientific and technologic base and also to the United States Amateur Radio Service.

Since the early 1980s, I've been convinced that an easy-to-obtain ham ticket with fairly broad operating privileges is the singular way to attract youngsters to the hobby and then on to technological careers. And that is why I am so disappointed, if not openly outraged, with P.R. Docket 90-55. It simply takes away one artificial barrier—the Morse code—and replaces it with another—an additional 30 questions on top of those already needed to get a Novice ticket. I personally prefer an approach that would remove both the CW requirement and 10 meter SSB privileges from the current Novice ticket.

The FCC believes that no license holder should lose any operating privileges he now has. Current Novices would retain their 10 meter voice privileges. New codeless Novices would be permitted some Novice CW privileges on the high frequency bands for on-the-air code practice.

As in other nations who permit their no-code hams to operate HF—whether CW and voice or only CW—another regulatory stipulation would permit United States no-code hams, operating CW on HF, to make contacts with only the domestic U.S. and possibly U.S. possessions. This would be an "everybody wins" situation for any who support code-free licensing. Only those diametrically opposed to any form of no-code can really find fault with it.

My proposal would also carry another requirement: That testing for the Novice class license be brought under the auspices of the VEC testing system. The commission would not have to fear that any Novice tickets were being obtained surreptitiously.

But, as I noted last month, Public Law 259, which permitted the creation of the VE testing system in the first place, carries the stipulation that the Novice class ticket would never carry a charge for testing. It's too bad that its sponsor, Senator Barry Goldwater K7UGA, didn't forsee the semantics game the FCC staff would play to try to get around this. It's like saying that changing the name of the entry level license from Novice to Communicator changes everything and makes it all right for the FCC to violate federal law. This is a case where the FCC could probably be hauled into court and would probably lose, but I think that there is enough ill will between those who govern and the rest of us who must serve. So I offer the following alternative.

I will boldly suggest that the FCC simply direct all VECs and VE teams to give Novice tests at no cost to the applicant! Call it a cost of being in the VEC business if you want. This proviso might make some VECs unhappy, but others already offer no-cost service. Among them are the PHD ARC group in Missouri, and most of the individual teams in the De Vry program.

Getting congressional action might take longer than some might want. Also, there is no guarantee that such legislation would not get attached as a rider to some unrelated bill and wind up as part of a presidential veto. No, my way might not prove popular, but it is a logical way to appease the FCC's demand for better test security. It meets yet another FCC criteria—that the implementation of no-code cannot cost them anything in the way of financial or manpower resources. My plan won't. In fact, nothing at all changes for the FCC.

I give the FCC credit for fielding the no-code issue once again. It has always been a can of worms, and I can feel for people in the commission like Ralph Haller W4RH and Johnny Johnston W3BE, who are again the targets of much criticism from many in the nation's amateur community. Some of the criticism is without foundation, but some of it is justified. To paraphrase an old political adage, you gain little by taking a donkey, painting it gray, and calling it an elephant. If it brays like a donkey and kicks like a donkey, it's still a donkey. The Communicator ticket, for all intents and purposes, is like a Novice ticket with a Communicator-colored coat of paint.

This being the case, I contend that the Communicator be afforded the same protection under Public Law 259 as the Novice. I ask the FCC to think about what they would have done if the law simply stated that the "entry level" test, rather than Novice test, be free?

Déjà Vu Department

About a decade ago, a Los Angeles area amateur named Richard Burton was arrested and tried for operating a radio transmitter without a license. I knew Richard from the old Palisades Amateur Radio Club of Culver City. To his credit, he was among the most amiable people one could run into at a P.A.R.C meeting, or on the club's repeater in the early to mid 1970s.

For years, Burton had held the callsign WB6JAC. How he came to have his ticket pulled by the FCC is a lengthly story; suffice it to say that Burton didn't go off the air when ordered to. He was arrested, charged with unlicensed operation, tried, and found guilty. Burton eventually spent seven months in a federal prison, followed by five years of probation during which he was ordered by the court to keep away from any and all radio transmitters.

In November 1989 Burton guested on the highly controversial Tom Leykis Radio Talk Show on KFI-AM in Los Angeles. Leykis, whose on-the-air activities have been cause for FCC action against KFI, brought Burton onto the show because of similar troubles he was having with the government, according to the program's producer, Alan Eisenson. During the hour-long appearance, Burton (who reportedly had been granted permission by the parole board to appear) explained his side of the story and sparred with callers. Leykis asked him if he intended to try to get his amateur license back, to which he replied, "Well, if Big Brother [the FCC] will let me. My five years of probation is nearly up and we'll see."

After his probation ended, Burton did attempt to obtain a new amateur ticket. According to Fred Maia W5YI, he was tested under the W5YI-VEC program and passed. The papers were forwarded to the FCC, but it appears that they were intercepted. At this writing, it is unclear if Burton was denied a license based on his prior record or if the matter was still under advisement at the time of Burton's latest arrest.

It came as a surprise to me to learn that the same Richard Burton has been arrested once again for allegedly operating a radio transmitter without a license. Burton's arrest came on May 17 following what has been described as an intensive investigation by Los Angeles area FCC engineers acting on numerous complaints coming from the amateur community. Two weeks before his arrest, a search warrant was served at Burton's residence while he was at work. The FCC engineers and U.S. marshalls gained entry to his apartment where they seized about $1,000 worth of amateur radio gear.

At his arraignment on May 18, the former radio amateur was charged with three felony counts of violating sections 301 and 501 of the U.S. Code. In a surprise move, government prosecutors requested that Burton be held without bail because during the search of his premises after his arrest, they claimed that a target was found with a photo of Judge Real pasted to it in the bull's-eye. The presiding magistrate denied the motion, setting bond at $10,000. Burton was remanded back to custody awaiting posting of bail. A not guilty plea on all counts was entered on Monday May 21 in Los Angeles Federal Court.

But it does not end there. The following day, Burton was again denied bail and ordered to stand for a psychological examination after testimony by Los Angeles attorney Joseph Merdler N6AHU that he and others heard someone alleged to be Richard Burton on the 147.435 repeater reading names of people on a so-called "kill list." The names on the list are supposed to include FCC F.O.B. Engineer-In-Charge Lawrence D. Guy, Judge Real, Merdler, and others.

And there is still more. A week later federal court judge Robert Takasugi apologized to the former ham for extending his incarceration and then set him free on his own recognizance after the court-ordered psychiatric examination proved that Burton posed no threat to any member of society. When the results of that examination were known to the court, Burton's attorney requested that the $10,000 bail be reduced. Judge Tagasuki went one step further. He apologized to Burton on behalf of the court for the additional week of incarceration. He then set him free on his own signature. Burton's trial is scheduled to begin in early July. It may be concluded by the time you read this. If found guilty on all charges, the former ham could face a hefty fine and up to six years in a federal prison.

Burton Isn't Alone

Richard Burton is by no means the only individual feeling Uncle Sam's regulatory sting. The commission, with the concurrence of the Department of Justice, appears to have embarked on a new wave of enforcement in all services, especially those in the category of "personal communications." Many fines are being issued, and in some cases charges are being filed.

In a case similar to Burton's, the Department of Justice is proceeding with civil action against Dwayne Mayo of Jamaica Queens, New York. Mayo faces civil charges stemming from his refusal to stop using his CB radio after being issued a cease and desist order by the FCC. on April 24, commission engineers and U.S. marshals shut down Mayo's operation because he was causing TVI, had failed to pay a $1500 fine and not stopped operating. A search of Mayo's residence revealed 27 pieces of radio equipment, including five linear amplifiers. At least one of these was capable of running 2000 watts of output.

Playboy Jammer

Then there is the alleged "Playboy Jammer." Thomas M. Haynie of Virginia Beach, Virginia, has been indicted by a grand jury in the Eastern District of Virginia, charged with three counts of intentional interference and three counts of unlicensed operation of a satellite uplink. The indictment alleges that on September 6, 1987, Haynie was uplink operator on duty at the Christian Broadcasting Network facility in Virginia Beach. On three separate occasions an electronically generated video text message completely captured programming carried on two satellite transponders—one each on *GE Satcom IV* and *GTE Spacenet I.* The government intends to try to prove that it was Haynie's actions that jammed feeds of the Playboy channel. If convicted, Haynie also faces the possibility of prison and heavy fines. (*FCC News*, 27 April 1990).

Non-Maritime Fine

Acting on information from local hams, the FCC's Seattle Office identified and fined George M. Muchin of Redmond, Washington, for unauthorized and unlicensed operation of a marine radio transmitter. The FCC alleges that Muchin, who owns Redmond Plumbing, was being assessed a $1500 forfeiture for using 156.575 MHz for conducting non-marine business. Mobile direction finding equipment was used to trace the transmissions first to a worker's truck and then to a private residence. (FCC Public Notice 30 April 1990.)

Michigan Scanner Law Favors Hams

We will close this month with some good news coming from Michigan by way of Chicago, Illinois, from my friend and associate Hap Holly KC9RP. He reports that finally, on May 23, after three years of hard work by the Michigan amateur radio community, Michigan Governor James Blanchard has signed a bill into law that permits hams holding a Technician or higher class license to operate in their cars handheld or mobile equipment capable of scanning law enforcement frequencies. The new legislation amends a previous law that permitted such activity only by hams holding General/Conditional Class or higher licenses.

The new law still excludes Novice Class operators. Jim Brooker NI8E, a witness to the bill's signing, speculates that Novices were excluded because the majority of VHF emergency communications in Michigan takes place on 2 meters, a band not open to Novice operation. Therefore, it is not necessary for Novices to carry such gear in their vehicles.

The signing ceremony was aired live over a statewide network that included some twenty amateur repeaters. While the new bill appears to be a step in the right direction, Michigan remains one of four states that have such restrictive laws. The others are Minnesota, Kentucky, and New Jersey.

The ARRL has placed a request before the FCC for the issuance of a "Declaratory Ruling" stating that such laws be preempted by the federal government. Consequently, the FCC has issued PRB-3—known in some quarters as the "Mendelsohn Law," after ARRL Hudson Division Director Steve Mendelsohn WA2DHF who is leading the fight for its adoption and implementation. According to Benn Kobb KC5CW (*Federal Communications TechNews*), possible FCC action regarding PRB-3 in general and scanner laws in particular may take place sometime in 1991.

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HOMING IN

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Alabama Action

If there is one thing that equals the excitement of going on a T-hunt, it's talking about T-hunting with someone who is really enthusiastic about it. I have been in the lucky position of being able to correspond with foxhunters all over the world, but no one has exceeded the zeal of Bill Levey WA4FAT of Birmingham, Alabama.

"It's a hoot," was his immediate reply when I asked him what he thought about his recent RDF adventures. "It really revved my motor."

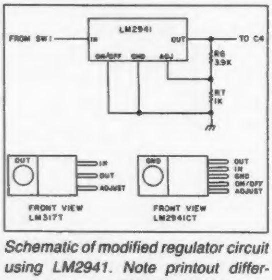
The Birmingham Amateur Radio Club has a monthly 2 meter hunt with boundaries that encompass the entire greater Birmingham area map. That covers parts of three counties, including urban, suburban and rural terrain, plus rolling hills and woods.

The hunts are on Sunday afternoons, and sometimes 40 hams converge at the hilltop starting point. Saturday night hunts didn't work out well, Levey says, especially during college football season. There are two winners possible for each hunt: one for the shortest time, and one for the lowest mileage. The Hunt Committee then determines who hides next time.

"I can't imagine any area in the country being more excited about DFing," Levey enthused. The club has branched out to put on special hunts, such as a recent on-foot outing in Oak Mountain State Park, with three transmitters scattered over a wide area. There is even talk of a regional DF championship now that there is increasing foxhunt activity in nearby Montgomery and Huntsville.

Birmingham hunters use a variety of RDF methods in pursuit of the foxes, including Dopplers and a dual antenna unit of Coast Guard design. Parasitic antennas seem to be the most popular choice at the starting point. Long beams aren't needed because signals are usually quite strong. Two-element quads are popular because they can be stuffed into a car trunk without disassembly before and after the hunt.

For occasions when more gain is needed, a few enterprising hunters use an add-on set of two yagi-type directors that "plug in" to the boom of the 2-element quad. This turns the antenna into a 4-element quagi.



Schematic of modified regulator circuit using LM2941. Note printout differences between LM317 and LM2941.

While many hunters in Birmingham and elsewhere like the antenna fabrication part of RDF as much as the foxhunting part, others would prefer to let someone else handle the building chores. WA4FAT's company (Alabama Amateur Electronics) makes it possible with a line of lightweight quads for 28–450 MHz. I'm experimenting with one of AAE's 2 meter models right now and I'll give you a full report soon in this column.

Unfinished Business

Last month I described how to adapt the Optoelectronics model CCB bug detector for sniffing out the fox at the end of the hunt. I was disappointed that the Optoelectronics board uses the LM317 voltage regulator to obtain the +6.25 volt reference for the display. The LM317 has high offset voltage so it falls out of regulation when the supply battery voltage drops below 7.9 volts, causing a drastic reduction in sensitivity.

One-chip low offset voltage regulators have been around for some time, but most either can't be set to +6.25 volts or don't have enough output current capability. After lots of research, followed by a bit of impassioned pleading with the local sales office, I got a National LM2941CT low offset high current adjustable regulator.

The LM2941 goes onto the CCB board with a couple of minor modifications. First, remove the 240 ohm resistor at R6 and substitute a 3.9k resistor. Next, unbolt and remove the LM317. Looking at Figure 1, you can see that the 2941 has two additional leads, and the INPUT/OUTPUT pins are in different locations. Furthermore, the tab is at ground on the 2941 and connected to OUTPUT on the 317.

Bend the ON/OFF and GROUND pins up out of the way temporarily, then bend the OUTPUT pin under the INPUT pin and solder the ADJUST, INPUT and OUTPUT pins into the proper holes on the board. Make sure the INPUT and OUTPUT pins do not short to each other. Finish off the job by connecting the ON/OFF and GROUND pins to nearby ground foil with a short jumper wire.

Do not bolt the 2941 to the board—that will short the output to ground. Put a piece of electrical tape between the IC and the board to prevent inadvertent contact at the mounting hole. You will get much better battery life with the new regulator because the reference stays solid with battery voltage down to 6.5 volts.

The LM2941CT came out less than a year ago, and it is hard to get. It's carried in the Advanced Computer Products catalog (1310 E. Edinger Avenue, Santa Ana CA 92705). Call ACP at (714) 558-8813 or (800) 366-3227. Cross your fingers because that part sells out quickly.

Hunters' Forum

If you live in a part of the country where there are only a few months of good hunting weather and only a couple of hunts in a year, it may be hard to believe that RDFers could lose track of local hunt happenings. But with over a dozen hunts a month from which to choose year-round, Southern California T-hunters can easily get confused. (Let's see, who's hiding the Path finder hunt this weekend? Ron won last month, didn't he? Or did he win the Rio Hondo hunt?)

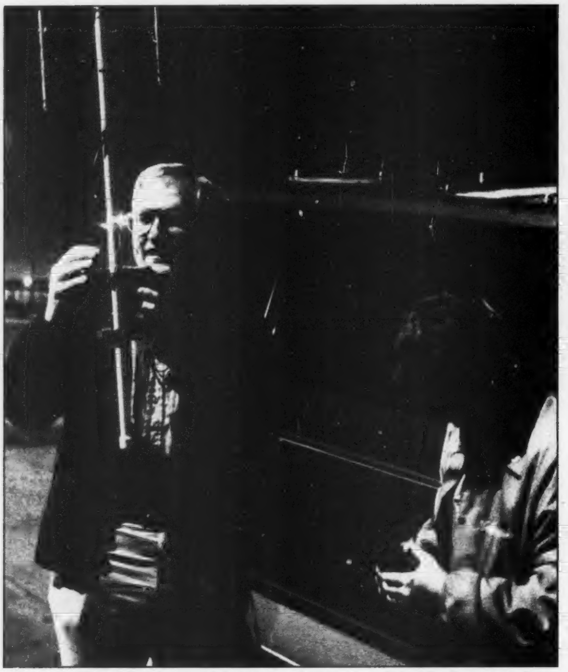


Photo A. KB6MAH caught ye olde columnist (with the sniffer) and expert navigator WA6OPS (dialing the HT) while experimenting with high speed film.

To help reduce the confusion and promote competitive foxhunting, Martin Hasa KB6MAH is publishing *T-HUNT FORUM*, a monthly newsletter for Southern California T-hunters. It lists all the upcoming hunts of the month, plus the results of hunts in the past month. Martin welcomes and encourages reader input. His informal, humorous style captures the fun of foxhunting very effectively. Hams may not yet be ready for a national T-hunt newsletter but when they are, I nominate KB6MAH to put it out. Meanwhile, a regular local flyer like Martin's might be just the thing to jump start the interest in your area. Martin won't do subscriptions, but he will mail you some recent issues if you send an SASE to him at 701 West Maxzim Avenue, Fullerton CA 92632. The more postage you put on the envelope, the more issues he will send. I suggest two or three ounces worth. (Southern California hunters must pick up their current issues at the starting point of a hunt.)

Martin is an accomplished photographer, too. You will see his photos in most *T-HUNT FORUM* issues. He has also done darkroom work on many of the pictures you have seen in "Homing In." He loves to experiment with new gimmicks in both photography and T-hunting. Recently, he combined the two when he took pictures of a night hunt using available light and ultra-fast film (see Photo A).

Are You Lost?

For some time now, we have been tantalized by stories of new navigation systems for cars that will be available "real soon now." A computer will keep track of your car's position in real time, and guide you through the city as you search out the hidden transmitter. It sounds like T-hunt heaven. Imagine connecting your antenna indicator and compass to a navigation computer to plot bearings, do triangulations, and figure out the way to get to the T with minimum time or mileage, whichever will win the hunt!

That day may be getting closer. Klynas Engineering of Simi Valley, California, has released "Streets on a Disk," a software package for IBM computers, with maps said to be available for the whole USA. You can even print out customized directions to your destination.

Before you get too excited, look at the price tag: $225 for the software and a basic USA interstate highway map, plus additional bucks for each detailed map. For example, the Orange County, California, map costs $570 by itself. Gosh, some of our hunts include four or more counties!

And the software doesn't talk to your antenna pointer, at least not yet. Then there is the matter of trying to operate an IBM computer in your car without RFI killing the weak signals. Worst of all, navigation software is intended for city use, not those new not-yet-on-the-map housing tracts and out-in-the-sticks canyons and washes. What we need here is "Boonies on a Disk!" But, seriously, I'd like to hear from any T-hunters who have occasion to try out this package, or anything like it. (My trusty old Kaypro won't run it.) If you think it has foxhunting possibilities, we'll put out the word in this column.

Number 24 on your Feedback card

ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
7 Simpson Ct.
S. Burlington VT 05403

Hints, Kinks and By The Numbers

Recently I've received some letters with good comments and suggestions, and I thought I'd pass a few of them along.

I mentioned in my article, "Cassette Box Special," in the April 1990 issue, that melting seemed to be the only way to make a hole in a cassette box without cracking it. John WR0W suggests using a drill bit with deliberately-dulled outer edges. "That way," he says, "the center cuts and the edge melts." I haven't tried it, but it sounds like a good idea.

W4DZA mentions a problem that may not be one. He says, "If your HF set jumps frequency a few kHz when it is keyed, check the RIT before sending it in for repair." I guess that would be easy to overlook. And there's no question that most electronic items sent in for repair are not actually broken.

Kenneth WA2VWS takes issue with my statement that a 600 ohm mike will not work well into a 50k ohm input. He states, quite correctly, that mike inputs usually are voltage-responding, and do not care about maximum power transfer. That's true, but that's the reason it doesn't work well. A 600 ohm mike will have low voltage at higher current, and the voltage-sensitive 50k ohm input will not be driven nearly as hard as if the proper mike were used. If the speech amp has enough gain, it may be OK, but in my experience, the audio will be weak, with corresponding weak transmit power on SSB.

Several readers have asked about the availability of PC boards for The Banker (also in the April issue) or of finished units. I'm afraid I can't help either way. The Banker is no longer in production, and there aren't any spare boards. It's really a simple project, and a great introduction to home-brewing. So come on, folks, build them! You don't have to use a PC board—perfboard or point-to-point wiring will work fine.

Finally, I'm still getting antenna questions and letters with SASEs. The purpose of this column is to discuss troubleshooting and basic theory, with a slant toward modern solid state gear. I don't do tubes, amps, tuners or antennas. And much as I'd like to, I just can't send personal replies, except on rare occasions. So please, save your stamps. Now, let's get to this month's topic.

Playing the Numbers

If you fix or build anything electronic, you're going to deal with numbers. The field is inherently numeric and, whether you're setting controls, using a scope, or just checking your transmitter output on a wattmeter, you're going to run into big numbers, little numbers, and especially metric numbers. Resistors, capacitors and other components, as well as quantities like amps, volts, ohms, watts and frequencies, are specified using the metric system, and for good reason. Being able to multiply and divide by factors of ten makes everything tremendously easier. Imagine if there were 12 ohms to a foot-ohm and 36 watts to a yard-watt! What a headache.

Luckily, it's easy to learn the metrics for scientific use, because you don't have to *unlearn* anything else first. Here are the metric units commonly used in the electronics game:

Giga (G) :	times 1,000,000,000
Mega (M) :	times 1,000,000
Kilo (k) :	times 1,000
Milli (m):	divided by 1,000
Micro (µ):	divided by 1,000,000
Nano (n) :	divided by 1,000,000,000
Pico (p) :	divided by 1,000,000,000,000

Wow! Some pretty crazy numbers, huh? Yes, but they are very useful. In order to do any calculation with them, though, you really need to put them into a more easily-manipulated form. As they are, they're just too cumbersome. Enter good ol' scientific notation.

Ten to the What?

You probably remember this from high school. It's just a way of describing the number of zeros attached to a number. For instance, Mega is 10^6. In other words, a 1 with six zeros after it, or 1,000,000. The whole range looks like this:

Giga (G) :	times 10^9
Mega (M) :	times 10^6
Kilo (k) :	times 10^3
Milli (m):	times 10^{-3}
Micro (µ):	times 10^{-6}
Nano (n) :	times 10^{-9}
Pico (p) :	times 10^{-12}

That looks a lot neater, doesn't it? And it makes it easy to put very big and very small numbers into formulas without juggling unwieldy blobs of zeros around.

Notice that there are no more "divided by's." To make division into multiplication, all you do is put a minus sign next to the exponent. So, 5 divided by 10^3 is the same as 5 times 10^{-3}. Multiplying is easier than dividing any old day, and keeping it all the same avoids confusion. Also, notice that all the powers of 10 (the "exponents") are grouped in three's: 10^{-3}, 10^{-6}, etc. This standardization of groupings makes it easier to mix or operate on the numbers.

For instance, how would you add two capacitors in parallel if they were specified as 1 x 10^{-8} and 5 x 10^{-9} farads? Sounds messy, huh? How about if they were 0.01 microfarad and 0.005 microfarad? That's easy; it would be 0.015 microfarad (0.015 µF). See what I mean?

You'll find this system in virtually all aspects of electronics. If, for instance, you use a milliammeter, you're measuring amps times 10^{-3}. A circuit drawing 700 mA is drawing 0.7 amps. It's as simple as that. And if you use a frequency counter and measure 14.2 megahertz (MHz), that's 14.2 x 10^6 cycles per second.

All this really comes together when you use instruments like scopes and DVMs. I strongly recommend that you get a scientific calculator. They're cheap these days (around $15) and are worth their weight in gold. You may never need all those fancy mathematical operations (doesn't it hurt to know that a $15 box knows more math than we do?), but the ability to calculate using exponents is vital. Most scientifics have an "engineering notation" button, which simply takes answers like 5 x 10^{-2} and converts them to 50 x 10^{-3}, in accordance with the handy groupings described above. Also, some of these machines can do number base calculations and conversions, and these are really useful if you do much computer programming.

If You've Got the Time . . .

If you've got a scope, its horizontal timebase (sweep speed) is undoubtedly calibrated by time, rather than sweep frequency. Only very old "recurrent sweep" (in other words, non-triggered-sweep) scopes used frequency markings. The time units are far more useful. They specify the length of time it takes the beam to sweep the width of one box on the graticule. So, if you have a waveform which makes a complete cycle in 2.6 boxes, all you have to do is multiply 2.6 by the setting of the sweep knob and you know the time period of each cycle.

But how do you figure the frequency? That's easy: just invert the number by dividing 1 by it. Let's say your waveform completes one cycle in 2.6 boxes with the sweep knob set to 5 microseconds. The total time for one cycle is then 2.6 times 5 x 10^{-6} seconds, or 13 x 10^{-6} seconds (in other words, 13 microseconds). To get the frequency, just divide 1 by 13 x 10^{-6} and you'll get 76.9 x 10^3 or 76.9 kilohertz.

If you have a dual-trace scope, you can measure the time difference between two waveforms as long as their speeds are related to each other. (If they weren't, their time difference would constantly be shifting, just like two watches running at different speeds.) If one wave starts its cycle 2 boxes after the other, then it lags by 2 times 5 x 10^{-6} seconds, or 10 microseconds. (This assumes, of course, that you still have the sweep knob set to 5 microseconds.)

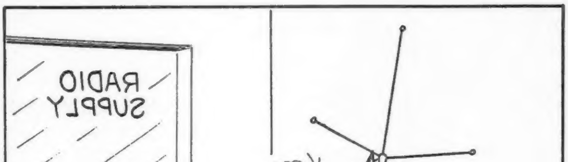
If you'd like to express the time difference as a phase angle, all you do is relate the time to the magic number 360, which is the number of degrees in one cycle, no matter what its actual time period may be. For example, if the first wave has a total time period of 13 microseconds and the second wave lags by 10 microseconds, the second wave is out of phase by: 10 divided by 13, times 360. Thus, it lags by 276.9 degrees. This kind of information can be extremely useful if you're trying to service a frequency synthesizer, ATV video camera, packet modem, etc.

These same kinds of tricks work great with meters, digital or analog. If you've measured 50k ohms, that's 50 x 10^3 ohms. If you've got 0.03 amps, that's 30 x 10^{-3} amps, or 30 milliamps (mA). But why bother to call it 30 x 10^{-3} amps when 30 mA sounds so much better?

It's the Law

When using Ohm's law, or any other formula, always remember to use the exponents. If, for instance, you want to know the current through a 10k ohm resistor with 6 volts applied across it, just divide 6 by 10 x 10^3, and you'll get 0.6 x 10^{-3}, or 0.6 milliamps. That's also 600 microamps (600 µA).

So, get a scientific calculator and experiment! Once you see the relationships of the metric number groupings, you'll find your electronic work much easier. Even if you don't design anything yourself, your enhanced ability to calculate currents and other quantities while troubleshooting will speed you along. Plus, that new scope you got at the hamfest should seem a whole lot clearer. Good luck x 10^{12}!



YOU DO HAVE TO KEEP YOUR QSO's QUITE SHORT

Number 25 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

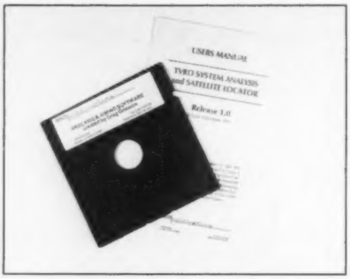
MFJ DELUXE VERSA TUNER II

PRODUCT OF THE MONTH

MFJ

The MFJ-948 is a 300 watt antenna tuner that tunes out SWR for maximum power transfer to verticals, dipoles, inverted Vees, beams, quads, mobile whips fed by coax, balanced lines or single wire—virtually any HF antenna. It covers 1.8 to 30 MHz and is made in the U.S.A. This deluxe antenna tuner features MFJ's lighted peak reading cross-needle SWR wattmeter with an ON/OFF switch for the meter lamp. It will show you SWR, forward and reflected power at a single glance. It also reads average power. It reads power on two scales: 30 or 300 watts. Besides the lamp switch, other front panel meter switches let you select PEAK/AVERAGE power and HIGH/LOW power scales. A 6-position antenna switch lets you select two coax lines (direct or through tuner), random wire, balanced line and external dummy load. A 4:1 balun makes it easy to hook up balanced line antennas.

The MFJ-948 is priced at $130. The lamp uses 12 VDC or 110 VAC with MFJ-1312, $13. For more information contact any MFJ dealer or *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762. Phone (601) 323-5869 or (800) 647-1800, FAX (601) 323-6551, Telex 53 4590 MFJSTKV*. Or circle Reader Service No. 201.

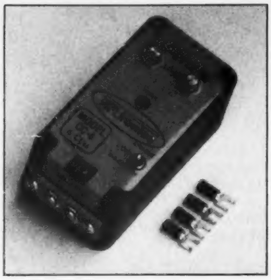


BAYLIN PUBLICATIONS

"TVRO System Analysis and Antenna Aiming Computer Programs for Satellite Technicians" by Greg Grissom, from Baylin Publications, is a software program for IBM and compatible computers. It can be instrumental in TVRO system analysis and antenna aiming. This tool for designing and installing TVROs is tailored for satellite professionals, dealers, and technically-oriented TVRO owners. It can also be used in sales presentations to demonstrate how changing parameters, such as dish size or LNB noise temperature, affect picture quality. The analysis subcomponent, especially useful for predicting performance when viewing signals from a particularly weak satellite, accurately calculates picture quality from footprint maps and system parameters such as LNB noise temperature and antenna diameter. The aiming subcomponent is used to calculate azimuth and elevation angles and the range to all satellites within "view" of a TVRO.

This software is available on 5.25-inch and 3.5-inch floppy disks for $50, plus $2 S & H, from *Baylin Publications, 1905 Mariposa, Boulder CO 80302*. Or circle Reader Service No. 204.

RF TRONICS



RF Tronics, a company that specializes in custom electronic hobby accessories, has solved the memory problem in nickel-cadmium batteries with the CAD-CYCLER. The CAD-CYCLER helps restore a battery to its full amp-hour capacity by properly discharging the pack to a precise, recommended level. Full capacity is usually restored in three charge/discharge cycles. Repeated use of the CAD-CYCLER will help prevent memory from ever forming and will maximize the life span and number of charge/discharge cycles that your batteries were designed to produce. The CAD-CYCLER can be used on any battery as long as the number of cells in the pack match the model number: Models CC-4, CC-5 and CC-8 discharge at 500mA; CC-6 and CC-7 at 600mA.

The special introductory price for all models is $35 each (regular price is $39), plus $2.50 S & H. Contact *RF Tronics. P.O. Box 718, Agawam MA 01001-0718. (413) 786-6162*. Or circle Reader Service No. 202.

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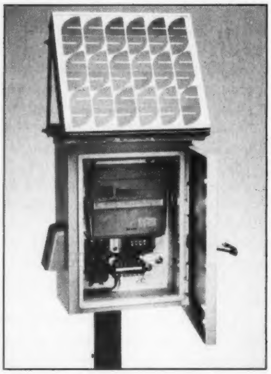

The Solar Power Pack (SPP) from Heliopower, Inc., is a complete, self-contained DC solar power system available in three standard sizes. It includes all the components of a solar power system: a high-performance photovoltaic (PV) module for efficient collection of solar energy, a charge regulator for precise charging and discharging control, plus a sealed, deep-cycle, low-maintenance storage battery. These components come completely assembled in a weatherproof NEMA 3R enclosure with hardware for various mounting applications.

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CYBERRESEARCH

CyberResearch has released a new, enlarged edition of *PC Systems Handbook for Scientists and Engineers*. This new catalog (Volume 7, Number 1, Spring 1990) contains many new products for PC-based data acquisition and instrumentation control. CyberResearch has assembled a large selection of compatible products, saving users the many hours of research required to find products that will work together. Detailed applications diagrams of several data acquisition and control systems provide helpful examples for those who wish to understand PC-based products for laboratory and industrial use. The handbook is filled with detailed Tech Notes which explain complex concepts and new developments in data acquisition equipment. It provides a wealth of technical information and serves as a combination technical reference and catalog.

To request a copy of this catalog contact *CyberResearch, Inc., P.O. Box 9565, New Haven CT 06535. (800) 341-2525*. Or circle Reader Service No. 205.

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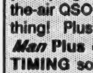

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Callsigns Galore

A callsign is more than just a method of identifying and recognizing a station on the air. If this weren't the case, there wouldn't be so many vanity or special callsigns in existence.

Given a choice, most amateur radio operators will choose a callsign with a "vanity" suffix, such as the operator's initials or a combination of letters with a special meaning, like CQ, DX, CW, YL, OM, etc. There are many examples of callsigns using the operator's initials in the suffix, especially in the U.S., and in DX operations, too: Jim Smith VK9NS as A51JS, T33JS and T31JS; Tom Warren (K3TW) from 5H3TW and others; and Dave O. Gutherie at 5N0DOG.

We shouldn't forget the callsigns whose letters and digits form words, such as W1ND, W0RE, K1SS and ST0RK. Then there are the April Fool callsigns, such as C0AX, FR0ZE, SL1M, and so on; these are cute, but bogus.

There is nothing new about this preoccupation with special or unique callsigns. Since the early days of radio, before official callsigns were issued by a government, many operators signed their initials or some special combination of letters. Let's face it, in our hobby we are primarily known by our callsigns, not by our given names.

You shouldn't be surprised to learn that many QSL collectors specialize in collecting prefixes and unique or commemorative callsigns. There's more to DXing than just hunting new countries and collecting 300+ QSL cards. Since the advent of the popular CQ WPX Award, the proliferation of rare or little-used prefixes has been overwhelming, especially during contests. The table shows a sample of some recent special callsigns using unusual prefixes.

Several countries are very liberal when allowing special prefixes. Brazil, Canada and Italy certainly top the list.

Official and Unofficial Callsigns

Under normal conditions, amateur radio callsigns are issued from blocks of callsign prefixes allocated to each country by the International Telecommuncations Union (ITU). However, there are exceptions. Several unused ITU callsign prefix blocks are being used for amateur radio operations without being authorized by the ITU. These prefixes are generally used for DX "countries" whose governments are not recognized, or who are not administered by any government.

Most of the unofficial callsigns come from the block of prefixes beginning with **1**. For example: 1A0KM—Sovereign Military Order of Malta; 1S—Spratly Islands; and 1Z—Karen State of Burma. There are others, but these three are best known. The international callsign prefix allocations are listed in the *Amateur Radio Callbook* and *The ARRL DXCC Countries List*.

You'll notice that many countries are authorized callsign prefixes from different blocks, hence their amateur radio operators can be inventive during special occasions and contests.

Romancing the Callsign

Romance? Yes. . . to many QSL collectors, whether dedicated or casual, the lure of a special callsign is more than they can bear.

What makes a special callsign? Any callsign of unusual form, size, or reason for being is collectable. A group of examples must include the following categories: No digit—6DAPAX (celebrating the Pope's visit to Mexico; a normal 6D callsign would have a digit after the 6D) and RAEM (ship's callsign assigned to Soviet Hero Ernst Krenkel). Short—PJ9A, CI7U, CT0B, LT4F, RI6O, ZX5C, IN1U, etc. Short and sweet—U2Q, M1C, T4A, U9Z. Unusual—TU73, JY1, TYA11, GB1IARU, TG0FRACAP, etc. Commemorative—3F75JC (75th anniversary of Panama independence), 9Y50NP (50 years of amateur radio), VR200PI (Pitcairn Island bicentennial) and more. Think of the possibilities . . . such as a DXCC of 1 by 1 callsigns!

Special Callsigns—Unusual Prefixes

3Z0E	Poland	HU1A	El Salvador
HG1S	Hungary	IL3A	Italy
SN3A	Poland	LT4F	Argentina
4M9X	Venezuela	RX9A	USSR
CQ5T	Portugal	TM2A	France
H73A	Nicaragua	ZX5C	Brazil

Embedded Information

In many callsign systems built-in logic helps identify geographical or political location, separate islands from the mainland, special categories, and so forth. For instance, at one time, all U.S. callsigns whose suffix began with an **X** were experimental stations. Some examples are W10XDA, W2XMN, and WE2XCC. A wealth of information can be learned from callsigns.

The structure of most callsigns uses the digit to identify a geographical or political area within the country. However, there are several countries where this is not true. In Argentina, for example, the digit is meaningless, but the first letter of the suffix identifies the station's location. The letters of the alphabet generally indicate provinces from north to south. The letter **Z** identifies stations located in the most southerly areas of Argentina—in the Antarctic areas (LU1ZE, LU2ZG, LU5ZR, etc.).

In the British system of callsign allocation the digit in the prefix does not have any geographical significance, but the callsign can often provide a clue about how long the operator has been licensed, or at least when the callsign was first issued (callsigns are not reissued except to family members or some organizations). All **G2, G3, G4, G5, G6** and **G8** callsigns with a two-letter suffix were issued before World War II (1920–1939). G2 callsigns with three-letter suffixes were "artificial antenna" permits (authorized to transmit into a dummy load only) issued in 1939. Since 1946, all new licenses beginning with G3AAA have been issued with a three-letter suffix (G3AAA–G3AZZ in 1946, G3HAA–G3HZZ in 1950 and 1951, G3NAA–G3NZZ in 1958–1960, etc.).

One unique feature of the British system allows British amateurs moving from one British "country" to another to keep the same digit and suffix. They simply change prefixes (G3AAA could sign GW3AAA, GM3AAA, etc.).

There is much more to learn about the romance of callsigns, with many interesting stories attached to them. What is the story of TYA11? Why did Ernst Krenkel sign RAEM (obviously not an amateur radio callsign) on the amateur bands? Old issues of ham magazines, DX bulletins, and DX handbooks tell the stories. It's part of the romance of DXing. If you're interested in learning about the formative years of DXing, an excellent way to begin is by reading *DX IS!* by Charles Allen W5DV and Jim Allen W6OGC. You can purchase a copy for $7.50 postpaid in the U.S. from Charles Allen W5DV, 42 Bob White Lane, New Braunfels TX 78130.

Next month I'll present an assortment of DX tidbits. 73 and DX.

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ATV

Ham Television

Bill Brown WB8ELK
% 73 Magazine
Forest Road
Hancock NH 03449

Dayton 1990

This year's Dayton Hamvention saw a record number of attendees at the ATV forum and meetings. The ATVQ and Western Washington ATV groups' Friday night meeting saw over 100 hams converging to meet fellow ATVers and watch presentations and video tapes. Jon WM8W had his gigantic ATV kite on display, Mike KD0FW and Bill WB8ELK talked about their balloon adventures, and Carl K5MWN put on an excellent demonstration of his unique flight simulator R/C airplane.

Tom O'Hara W6ORG chaired the ATV forum Saturday afternoon at the Hamvention. The room was packed with ATVers from around the country (and world) who had a chance to find out about the latest happenings in the ATV world. Lou McFaddin N5DID gave us all an idea of the upcoming SAREX missions with some details on Ken Cameron KB5AWP's ATV experiment on STS-37. Spec-Com held sessions at the Ramada Inn both Friday and Saturday evenings. Of particular interest was Harry Tootle's (remember Tootlevision?) presentation which gave us some interesting insights into starting up and running your own commercial low power TV station.

ATV Demonstrations

You don't have to wait for Dayton to meet up with other ATVers. If local activity is sporadic or nonexistent, don't just sit around watching a snowy screen. Get out there, spread the word and try to recruit new stations. There's nothing like a good hands-on live demonstration to really show off amateur TV.

Start out with a demonstration at your local radio club meeting. Arrange to have a nearby station send you a picture for some live two-way interaction. Show them what it takes to get started and top it off with a short video highlighting some of the locals hamming it up on television. If there is a nearby hamfest, talk with the program committee and arrange an ATV meeting. Spread the word in your club newsletter, hamfest fliers and any nearby ham or electronics stores. With some good advertising you should draw in a pretty fair crowd of potential ATVers. A good introduction to ATV videotape is available free for demonstrations and meetings from AEA. Write to them at P.O. Box 2160, Lynnwood, WA 98036 and include the club or hamfest location where you intend to show the presentation.

At the Dallas HAMCOM convention this year Andy WY5V chaired an excellent ATV forum. ATVers representing most of the state of Texas as well as Oklahoma and Louisiana were in attendance. It was a good place to find out about neighboring groups and discover their talk frequencies. A number of these groups are close enough to communicate with each other regularly as long as they know where to meet. Andy has been doing his best to stir up new activity in the Dallas area for a number of years with encouraging results. For more info on ATV in the Dallas/Ft. Worth and surrounding area call Andy on either 147.42 MHz or 144.34 MHz simplex. Andy also has a dedicated ATV hotline number at (214) 289–WY5V (289–9958).

The LISAT group (Launch Info Service and Amateur Television System) is located near Cape Canaveral, Florida. Their group is heavily involved in distributing info on upcoming shuttle flights to hams visiting the area. When in the area you can contact members of LISAT via the 146.94 repeater. They hold an ATV net on this repeater every Monday at 8:30 local time. K4GCC also transmits the NASA shuttle video out via an omnidirectional antenna on 434 MHz during missions. He uses a 16-bay vertical collinear antenna at 160 feet which provides good coverage around the space center and surrounding communities.

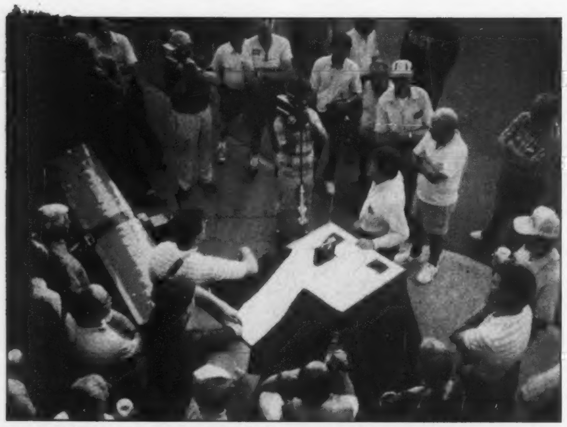

Photo A. Crowds gather around the K5MWN ATV R/C flight simulator at Dayton Hamvention.

Photo B. Andy WY5V at the Dallas HAMCOM ATV forum.

LISAT holds an ATV meeting four times a year at Merritt Island, Florida. This year they were able to really thrill everyone with live video transmitted from an airplane as it flew in to the meeting. You can contact LISAT via Ernie Baldini K4RBD, 453 Watts Way, Cocoa Beach, FL 32931.

Linked ATV Repeaters—Texas Style

The Tyler/Kilgore area of east Texas is home to two ATV repeaters. The W5KPZ repeater in Tyler operates with 434 MHz in and 421.25 MHz output. The K5KFC repeater, 26 miles to the east, is active with 439.25 MHz in and 426.25 MHz out. The two repeaters are linked up with two T.D. Systems FM ATV transceivers on 1255 MHz. Operating with just 1 watt of power, this provides both repeaters with a consistent snow-free link.

As long as no one is using the local Tyler machine, anyone operating through the Kilgore repeater will also be linked over and repeated out via the Tyler machine. Likewise stations in Tyler are linked automatically over to the Kilgore repeater. Both machines can be used independently (local TV contacts take priority over the link video) and the link activates itself whenever one of the repeaters is not in use. Jim WB5NLF in Shreveport, Louisiana, can work on over to Tyler (100 miles) with excellent signal levels a good share of the time.

In addition to the linking capabilities of the Tyler machine, Dave W5KPZ can also access the local weather radar by touchtone control of a 434 MHz (ATV repeater input) transmitter located at the channel 56 television site 30 miles away in Jacksonville, Texas.

The weather radar feed can be seen through both ATV repeaters and is a great help whenever the Skywarn net is activated during severe weather. Several fire and police departments in surrounding towns have installed downconverters to view the weather radar from the repeater. It's a great help to the whole community to know in advance when severe weather and tornadoes may strike.

Recently, the power of ATV weather radar was dramatically demonstrated. The Skywarn net was activated to investigate a line of severe thunderstorms approaching the area. The net control tuned in the weather radar feed and directed the mobile storm spotters to observe a particularly intense pocket of thunderstorm activity. The was a small hole right in the center of the storm that looked like the eye of a hurricane. Arlyn AA5BY approached the area and observed a tornado skipping across the highway just a quarter mile ahead! Tracking the tornado by weather radar ATV and chasing it across east Texas by car, the Skywarn group was able to relay its position back to the Shreveport Weather Bureau so that towns in the tornado's path could be warned. Walter KE5WH was able to take some excellent videotape footage of the rampaging tornado which was seen over the local TV stations several nights in a row.

R/C Flight Simulator With ATV

One of the most impressive displays at the Dayton Hamvention ATV forums was Carl Berry K5MWN's quarter scale airplane R/C complete with onboard color TV camera. Carl has modified an arcade racing game to simulate a complete aircraft cockpit. Using the ATV downlink signal, Carl can taxi it down the runway,

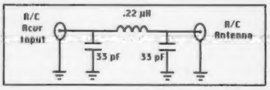

Figure 1. 75 MHz Low Pass Filter for R/C receivers. (courtesy of P.C. Electronics)

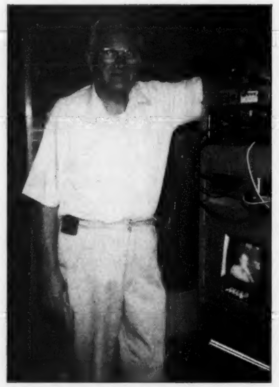

Photo C. Dave W5KPZ demonstrating the linked Tyler/Kilgore repeater system.

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Photo D. K5MWN R/C aircraft with onboard color TV camera.

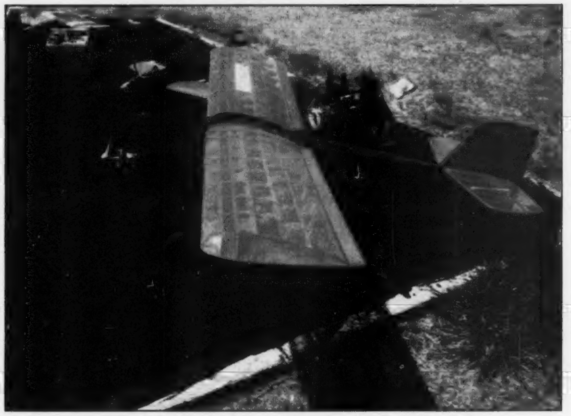

Photo E. R/C airplane with flight simulator in the background.

take off and land, without ever having to look at the model. The R/C ATV downlink is received in full color on a large TV screen right in his cockpit, allowing him to actually "fly" along with his model. He can even fly in formation with other modelers. Since the flight simulator is very close to flying a full-size plane, it takes a certain amount of flight training to fly it well. It's a totally different experience from flying an R/C model while looking at it.

His first attempts at using the 70cm band were not very successful, due to interference caused by the nearby ATV transmitter to his R/C receiver, so Carl used a 1 watt PC Electronics transmitter (TX-33) on the 900 MHz band. No interference problems were encountered, resulting in some really spectacular flights. In the near future, Carl will be trying out PC's new TXA5-RC for radio-controlled ATV on the 70cm band. With proper shielding of the R/C receiver, the 70cm band should work out well for R/C aircraft.

Choke Your R/C Receiver

Since we're on the topic of R/C aircraft using ATV, I thought I'd pass along some hints by Tom O'Hara W6ORG to help your R/C receiver get along with a nearby ATV transmitter. It seems that putting a 1 watt ATV transmitter next to an unshielded R/C receiver can spell disaster. You may have control of your plane at close distances but as the signal gets weaker your ATV transmitter signal can capture the first mixer of the command receiver, and down goes your model!

Through proper shielding and the addition of a low-pass filter at the R/C receiver, you should retain complete control of your plane. The first step is to mount the receiver in a shielded box using small pieces of PC board, copper or brass sheet. Mount a low-pass filter right at the R/C antenna input. (see Figure 1.) This filter should pass everything below 72 MHz but roll off a good deal of the 70cm ATV signal.

To test things out, place your R/C model at your maximum usable range for good control. Turn on the ATV transmitter and see if you still have control. If not, move your model closer to the R/C transmitter until you regain control. Add some 220 pF bypass capacitors on the positive power and servo lines. You can also adjust the ATV antenna and R/C antenna for best separation. Try to keep the ATV leads away from any R/C lines. If these changes still don't improve things enough, you may have to run each servo output lead and power line through 500 pF feedthrough capacitors with ferrite beads mounted on each side. Shield your ATV transmitter and camera in the same manner. The video feed can be left as is since it is already shielded by coax. Appropriate feedthroughs are available from the Marlin P. Jones catalog, phone number (407) 848-8236. They are listed as part number CF-1960.

Keep'em flying and stay tuned! 73

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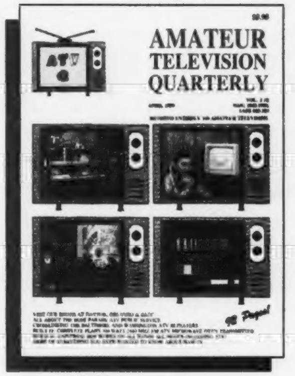

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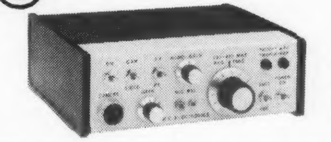

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More on 800 Hz Shift

The other day I got a telephone call from Andy Dimartini, President of Digital Radio Systems, Inc. (DRSI). It seems that Andy tried my idea of using the V.23 mode of the modem on the PC*PA and discovered that it worked better than the Bell 202 modem mode. He gave me instructions on how to switch the modem in the PC*PA from Bell 202 to V.23. Here are his instructions:

*V.23 is selected by taking TRS (pin five), TXR1 (pin 13), and TXR2 (pin 12) to ground. So, in general any PC*PA 1200 baud port can do V.23 by lifting pin 10 out of the inverter's socket* [I presume he means on the Type 1 board–WB6RQN], *and then grounding pin five on the modem. The modem's internal logic resets to the new configuration on the next power-up.*

This will work with any TNC that uses the TCM3105 modem chip. I modified my PC*PA slightly differently from the above instructions. Here's how:

Carefully remove the TCM3105 chip from its socket and bend pin five out so that when you plug the chip back in, pin five is disconnected. Connect the free end of pin five to ground. A convenient ground is pin nine on the same chip.

If you have a TNC where the modem chip is soldered to a board, the modification is more difficult because you will need to cut a trace on the circuit board and solder a wire from pin five of the modem to ground. If you are feeling exceptionally industrious you can add a small single-pole double-throw switch to change between V.23 and Bell 202 modes. That way you can make the change more or less on the fly (remember that the chip must have its power removed and reapplied to switch modes).

More on 10 Meter Packet

I received a nice letter (via BBS) from Andy N6VRP. Andy had a few good questions:

I read and enjoyed your article in the latest 73 on 10 meter packet. It was particularly timely for me since my latest project has been trying to connect with my home BBS (WW6L) using the nighttime ground wave propagation. I have had no luck as yet. It seems harder to punch through the hill between us (my QTH is Half Moon Bay) on 10 meters than on two. A better antenna should do the job. Ground wave 10 meters should have a lot of future for packet. There is no QRM at all at night.

A couple of items in your article bothered me. I hear WW6L at 28.1869 SSB on my HTX-100. He reports his transmit frequency as 28.190 as it reads on his dial. This corresponds to the upper tone 2100 Hz above the nominal carrier read by my dial. I believe this is the standard way of reporting frequency. Your article, however, implies that frequencies are reported on the midpoint. I have never seen that done.

A friend of mine has a Uniden 2600 and observes a long (over a second) hang time going from transmit to receive. AES refused to fix it, saying that it was normal for the unit. This would be deadly for packet, but you don't mention it. Do you have a mod to fix it? Or were you just lucky with your sample?

I really enjoyed the article, it hit my current interests exactly.

73 Andy (N6VRP @ WW6L)

Well, Andy, I am glad that the article hit your interests. I think that 10m is an almost unused resource for packet. As for tuning, there are many different ways to calculate your frequency. The technique I suggested in my May column is to calculate the center frequency between the mark and space tones, then add (USB) or subtract (LSB) this number from the carrier frequency to determine where your signal is. This technique works regardless of whether you are using upper or lower sideband. It identifies where your signal actually is in the spectrum. This is how a spectrum analyzer would display your signal and it is how the FCC sees it.

On the other hand, you are quite correct in that there are many people who subtract the high tone from the "desired" frequency to calculate where to set the frequency of the radio. This technique works so long as both stations agree to use upper or lower sideband. It also means that most of your transmitted power will be on one side or the other of the "desired" frequency. The bottom line is that it doesn't matter how you calculate your frequency so long as both stations use the same technique and your signal stays inside the spectrum allocated by the FCC.

As for the HR2600, mine also exhibits a long receiver recovery time but mine seems to recover more rapidly than one second (hi) since I seem to be able to copy stations with a 300 ms TX delay. You must also remember that most TNCs insert an extra ACK delay before switching to transmit. This extra delay is inserted by the TNC to accommodate some TNCs that occasionally drop carrier momentarily between packets. This extra ACK delay takes care of most radios that have an excessive receiver recovery time. In any case I will do some more experimentation with my own HR2600 to quantify this problem and to try to find a way to improve receiver recovery time.

Something Else to Try

Almost all terrestrial packet radio operation is half-duplex. You either receive or you transmit, but you certainly don't do both at the same time. There is another way to do it: You can use full-duplex to transmit and receive at the same time. Satellite users have been using full-duplex for some time now since it is relatively easy to transmit and receive at the same time through the satellite.

But why bother? Full-duplex requires you to have a separate transmitter and receiver. If you try to do full-duplex in a single band you need a very bulky and expensive duplexer, hardly something you are likely to have kicking about in your junk box. Well, I can attest to the value of the effort. Just what does full-duplex operation buy you? Well, in the data communications industry the standard calculation is that half-duplex will yield about 40% of the total throughput of full-duplex. My experience in packet radio is that this is more like 20%–30% because of the long turnaround times of the TNCs, modems, and radios.

Running a full-duplex link with another station is a real revelation. Your file transfers complete in a third of the time it usually takes. The AX.25 protocol can finally take advantage of its ability to use sliding windows (send the next packet even though the first packet hasn't been ACKed yet). When doing a file transfer your transmitter comes on and stays on while the receiving station transmits ACKs for every packet that comes in. If you have a good file transfer program like the FTP utility in the KA9Q Net/NOS program you can actually send files in both directions at the same time without slowing the transfers down at all!

The key to operating full-duplex inexpensively is to operate crossband, i.e. station A transmits on 2m and receives on 70cm while station B transmits on 70cm and receives on 2m. If you have one of the dual-band radios that include full-duplex capability you have everything you need already. Just enable the full-duplex mode of the radio and issue the TNC command FULLDUP ON to your TNC. This prevents your TNC from waiting when it hears something on the channel. It just goes ahead and transmits anyway.

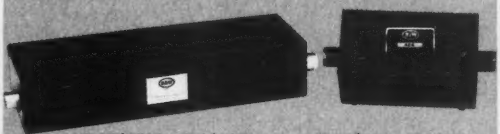
But what if you don't have one of those expensive dual-band radios or if 2M/70cm isn't convenient? I have found that the easy and cost effective way to make this work is to use a scanner for the receiver. Most scanners today will copy the 6m, 2m, and 70cm bands, and some will even copy the 220 MHz band and the 33cm band (902 MHz) as well. Radio Shack had a sale not long ago for a programmable handheld scanner that would be ideal for this use (it was under $100). All you need is a transmitter. If you have a 2m rig and a scanner for a receiver your partner can have a transmitter for almost any band and you can enjoy full-duplex operation.

There are some caveats with full-duplex: You can't share a frequency with any other stations; full-duplex operation is strictly point-to-point. So, when and where do you use it? How about on backbone links between NET/ROM, TexNet, or TCP/IP nodes? Here the flow of data would be GREATLY improved. It would go a LONG way toward eliminating the NET/ROM overload problem.

Try it and see. I think that you will like the difference. No, it is not for everybody, but for those who can use it, it offers a great improvement in performance. 73

T.V.I. problems?

Low pass T.V.I. filters from Barker & Williamson



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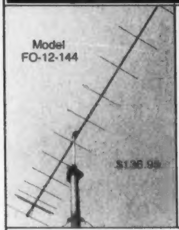

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Crystals, VXOs and VFO

During the Dayton Hamvention, a lot of people asked me why most QRP transmitters are crystal-controlled. The answer is really quite simple: STABILITY. However, crystal-controlled transmit does have several drawbacks. The number one problem is not having the correct crystal on hand when a BY4 is calling CQ. No one hears him but you and the only crystal you have is 3 kHz away!

I've always had a weak spot in my heart for FT-243 crystals. They were produced by the zillions during World War II. In my last transmitter project described in these pages, I used an FT-243 crystal. That will more than likely be the last one I build for some time. The price of FT-243 crystals has gone out of sight. I had to pay about $9 for each crystal. This is way too much for a small project. True, they don't wear out, and should last forever, but like the rest of the hams I know, I'm a tad on the cheap side.

From my side of the street, we have three options. First, we could continue using crystal control for our transmitter. Second, we could modify the crystal control scheme into a Variable Crystal Control or VXO. This gives us the stability of a crystal plus the movement of a VFO. And ultimately, we could use a Variable Frequency Oscillator or VFO. This last option has caused many a QRPer to go back to option number one.

Wanderies and Wobbies

What do we look for in VFO design? Well, VFO performance requirements are many and varied. Can we use (get by) with VXO operation? Will the end project be for mobile/field use? What about temperature extremes? As you can see, a lot of questions must be answered.

For our needs, long-term stability is foremost. If you've ever worked a station whose VFO moved on you during a QSO, you know the problem. Many people call this the "wanderies." The VFO wanders back and forth.

A second problem we must look into is called short-term stability. This shows up as woops and doops on your frequency. I like to call these the "wobbies."

It is really beyond this column to get into the ways and whatnots of a PLL circuit, so we'll just look at oscillators using LC circuits. Most of the common Colpitts and Clapp circuits can be used for VFOs. We won't get into the circuits this time, but we will take a good look at the hardware end of VFO building.

Keep it Cool

I've seen some really good VFO circuits fall flat because of unsatisfactory construction by the builder. What, then, can make or break a VFO? Several rules must be followed.

Use only the feedback necessary to keep the oscillator running. This will prevent (reduce) loading and pulling from the external load connected to the VFO. Keep the power level low. No need to convert the VFO into a 1-watt transmitter! This will only increase internal heating of the VFO's components. This is a real no-no. For good long-term stability, we must keep the VFO's components COOL.

Keep all heat-generating components away from the VFO. This includes PA transistors and power supply regulators. There are several tricks of the trade you can use to keep the VFO cool. One of the best tricks is to use several smaller capacitors in the LC chain instead of just one large capacitor. This will reduce heating of the capacitors.

The last rule must be to choose VFO parts very carefully. In the past I've always used silver mica caps for my VFOs. And I've always had some trouble keeping the VFO in one place. I've found out, through several Official Observer reports, that silver mica caps can produce unpredictable results. Polystyrene capacitors are a very good choice for VFOs. They are hard to come by, however most of the bigger mail order catalogs do stock them. You can also use NPO ceramic capacitors. DON'T use common ceramic caps for a VFO; the capacitors must be marked NPO.

After Capping it Off

If you're careful about capacitor selection, the next problem area is the VFO inductor. This one has always come back to bite me. If you use a toroid, you're going to have long-term stability problems. A toroid will change characteristics as the temperature changes.

Even the windings can change the frequency. Some builders wind the toroid and then boil it in water for several minutes. This anneals the wire, making for less drift as the temperature changes. The best choice would be a slug-tuned coil. However, these are very costly and hard to come by. If the slug-tuned coil has a low *Q*, we find the same problems as with the toroid core. Use only a high *Q* inductor.

All inductors must be mechanically secured to the VFO circuit board. In the past, the use of "Q dope" was the best bet. Well, I've never seen a bottle of the stuff. I use RTV, also called silicon sealer. It comes in a toothpaste-like tube and takes about 24 hours to set up. RTV can be messy to work with, but it does the trick. On the down side, it's almost impossible to remove the stuff. So if a part goes bad, get out the X-Acto™ knife and slice into it.

The last major trouble spot is the main frequency capacitor. For lack of better wording, the main "tuning cap." I would sure like to tell you to only use a double-bearing capacitor for your VFO. However, if you could find one, you wouldn't be able to afford it! So we are stuck with using whatever we can scrounge up.

I thought I had some really good luck when I purchased some surplus capacitors. Just the ticket for VFOs. They worked just great, but the trouble was that you needed a pipe wrench to turn them. Most of the time, an imported vernier mechanism is used for tuning the VFO, but it just doesn't have the torque to move the variable capacitor.

When you're putting your VFO together, avoid the use of double-sided PC board. The extra capacitance will cause trouble. Keep lead length as short as possible. Long leads will show up as inductors. These can, and do, cause parasitic oscillations. The same goes for PC traces. The traces must be short, direct, and to the point.

Make it Tight

This section is essential reading for builders of direct conversion transceivers. The VFO must be enclosed in a shielded RF-tight box. Transmitter RF can get back into the VFO and cause all kinds of critters to get out. Use feed-through capacitors for operating voltages and RIT circuits. Miniature RG-174 cable should be used between the VFO and stages of the first amplifiers.

Have you ever built a transmitter that seemed to work just fine with a dummy load, only to have an 8:1 SWR when you connected it up to the antenna? I have. Traced the critter back to the VFO. Seems the VFO did indeed have output on 7 MHz, along with a dozen other frequencies! I have two different methods of finding these unwanted frequencies.

First, I use a frequency counter. If the counter cannot lock onto the VFO's output frequency, you're getting more than one output. Second, I couple the output to my oscilloscope. The output should be a nice clean sine wave; if the wave has fuzzes (intentional distortions) on it, you've got critters riding on the output. Break out the de-coupling capacitors and ferrite beads. You're going to need them.

So the next time you're talking to someone using a new super rig with 400 memories, six VFOs and dual 4-1000s, tell 'em your rig is also quartz-locked frequency controlled. Running 2 watts! Next time we meet I'll have some guidelines and simple circuits for VXOs.

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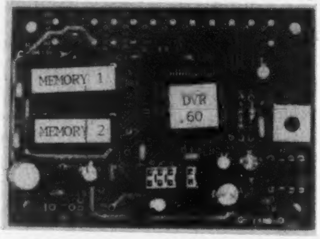

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CIRCLE 48 ON READER SERVICE CARD

Never Say Die

Continued from page 4

no votes from your club in the next election.

It may be a difficult concept to accept, but the ARRL is supposed to be serving amateur radio. Us. It's supposed to be responsible for making amateur radio fun, maintaining its growth and preserving its future. Well, their DXCC award is doing exactly the opposite. It's generating enemies for us in Third World countries. It's helping to turn away potential newcomers.

The Contests

Six DX contests a year, eh? Every couple of months all hell will break loose on the HF bands as DXers vent their pent up energies into an orgy of contesting. Sounds like fun. I love contests. I'm very good at 'em.

By having more "official" DX contests we'd encourage DXers to invest more time and money in their super stations. Clubs would put together multi-op setups. DXing would be more organized and might be even more fun. After all, only about half of the 400 IARU countries are usually active.

By concentrating contests into six weekends a year we'd also concentrate DXpeditions into these weekends. The result would be more clubs putting on DXpeditions in order to activate rare countries during contests. We'd all have more fun.

With DXpeditions liable to come on at any time DXers have to be ready when they fire up. With them only counting during scheduled contests DXers would be able to spend a little more time with their families. It might help cool their monomaniacal approach to DXing, making it fun rather than a life and death struggle.

Contesters are usually after every contact they can find during contests; true blue DXers will be after new countries. I got on in a contest a while back and, operating only on 20m phone, I contacted 100 countries in the one weekend, so working new ones during contests shouldn't be a serious handicap.

If I were running the League I'd get together with the IARU member societies and see which are most interested in running worldwide DX contests. I'd have the IARU certify six contests a year for all award credits. The IARU is run by the ARRL, which pays most of the bills for its operations, so the League should be able to get any agreements it wants.

Indeed, many IARU member societies get far more money out of their membership than they contribute just in trips for their delegates and their wives to IARU meetings which are paid for by the Union. The difference is made up by our benevolent ARRL, which uses this financial leverage to keep the member societies in a puppet relationship. Money may buy subservience, but it doesn't buy love. But of course, since you read the ARRL board minutes and the IARU column in *QST*, plus you undoubtedly discuss with DX ops how they feel about the ARRL and the IARU, you already know all about this miserable mess. Unless of course you are a poor Tech and are thus isolated from most of the ham world up on our lonely two meter outpost.

The Usual Digression

Speaking of Techs (well, writing), and if you are a Tech, to make a nag of myself (anything said twice is a nag), isn't it about damned time you bought my crummy 13-per code tape and spent about ten lousy minutes a day for maybe a week or so to pass the rotten code test? How many years have you been putting off this stupidly simple job? Lordy! Kids five years old can hack it. Has your brain really been so badly mushed by our incredibly awful educational system that you can't get yourself to do *anything*?

How am I going to get you to read, make some decent money, or develop some conversational skills so when we are in QSO I'll be able to get you to talk about something? How am I going to get you to stop swilling beer, slim down that disgusting paunch, get rid of your electric security blanket, kick the vile smoking drug habit and otherwise go about extending your life so we won't run out of hams so soon? I hear that death knell sounding with every "Silent Keys" column in *QST*.

> ***"Has your brain really been so badly mushed by our incredibly awful educational system that you can't get yourself to do* anything*?"***

Smoking. Since you probably don't read anything but ham magazines, maybe you haven't heard that research has recently shown that smoking is the number one cause of preventable death in America. Number two is alcohol and number three is breathing secondhand smoke. Yep, you're not only killing yourself, you're helping kill your wife, kids and friends.

ARRL—Shape Up

Getting back to DXCC. . . how about making it hot for the ARRL directors on this? You voted these turkeys into office, now get them to do something more than spend your money on vacation trips to board meetings, Geneva and so on. Ask for more than their normal contribution of unanimous votes at board meetings, rubber-stamping the party line.

Write your directors and demand that they get their idiotic and destructive DXCC in hand by limiting DXCC credits only to contacts made during officially authorized contests. And I don't even care if they play their usual politics with this by eliminating contests I got going such as the WPX and Worldwide DX Contests. I would suggest they pick a half dozen contests a year to authorize. And yes, if you get 'em to make this simple move, I'll get the DX Dynasty award rules into line.

You might let that turkey director you elected know that if he doesn't start making some waves you'll find a new turkey to elect. Get him busy updating the DXCC rules. Get him really interested in having the League set up a task force to clean up our bands. And another to seriously get working on ham growth. Make him start to work for the pork he's been getting from HQ.

Meet Your Director

When I first started getting involved with the political side of amateur radio almost 40 years ago. . . when I started editing and publishing my first ham publication. . . I was shocked and dismayed when I met the ARRL directors at conventions. I found myself listening to a bunch of drunks with utter contempt for the members. The worst, by far, was the ARRL general manager and *QST* editor, Budlong. Wow, what a bunch!

As the editor of *Amateur Radio Frontiers* for four years and then as the editor of *CQ* for five years, I got to know these chaps well. As the *CQ* editor I was the only ear ARRL dissidents had, so I heard plenty. Most ARRL members were fiercely loyal to this bunch of jerks and crooks, but I found there were a few members with the intelligence to actually ask questions and. . . horrors, think!

While I have some respect for a couple of the current directors and a lot of respect for most of the HQ gang, the more I hear about the current president, the less respect I have for him. Do you even know who is president now?

Let me put it this way. . . if you chaps out in Colorado re-elect your director I will lose what little respect I have for you. I know Marshall Quiat very well—know him from close personal experience. What on earth were you thinking when you elected him? Just plead stupidity and don't do it again.

Wayne For Dictator?

Several letters have asked why I don't run for ARRL president. I even got asked that during my talk at Hamcom in Dallas this year. Couple reasons. First, since I'm the editor of a competing magazine to *QST*, it would be a conflict of interest. But even if that weren't a factor I wouldn't be interested. I just want to get things done, I don't need or want the tremendous ego gratification such an exalted position would provide.

Yes, if I were to take over and run the ARRL, I think I'd have the organization revved up to the red line area in short order. I'd get the FCC to change the ham regs so we could start defrocking bum hams, even if they can copy 50 wpm code. I'd have one whale of a task force out there, supported by a thousand ARRL member clubs, hunting down every net jammer, every user of ham channels for business and every foul loudmouth. I'd have articles and stories about amateur radio in every newspaper, on every radio station and on TV so that every kid in America would know about it. I'd have the VECs so busy trying to cope with new hams they'd be crying uncle. I'd also be working with the Commissioners to set up a biannual Ham Radio Convention where delegates from clubs would formulate our rules for us.

There Goes Wayne Again!

Look, I agree it's a big job that needs doing, but I guarantee it isn't anything that can't be done. It could be managed by one person, too. Yes, I know how and could do it. Heck, I've tackled jobs like that in the past and I'm in the middle of a terrible mess in the music industry that I want to get cleaned up. Keep in mind, as the editor of *73*, there really isn't much more I can do than point out what needs to be done. . . and how to go about doing it. Beyond that I'd have to start by starting a new national ham organization, a battle which could take years and would certainly further weaken the hobby.

To give you an idea of how I tackle big messes, here's what I'm doing in the music industry. If the League were to go about solving amateur radio problems with similar creativity, we'd be home free.

The American music industry is in awful shape. Six international mega-corporations have gotten almost total control of it and are milking it for billions. Would you believe that the six majors in this industry have 96% of all music sales in America. . . leaving only 4% for over 5,000 small, independent (indies) music companies?

Worse, almost all of the creativity and progress is coming from these indies, with the majors tending to fight every inch of the way. So how can I fight an $18 billion well-entrenched cartel? I'm doing it by setting up projects which attack their weaknesses. I have 38 of these projects so far, either in the planning or in action. I call it guerrilla marketing.

The music business works like this: There are the record companies, both major and indies. They sell their records to distributors. These distributors sell to some 15,000 record retailers, who sell to the public.

The distributors are, for the most part, almost totally controlled by the majors. There are a few which specialize in handling indie music, but many of these got into the business because they found they could screw the indies easier than the majors. The majors are big enough to be unscrewable.

The public, oddly enough, tends to buy the music it hears over the radio and sees on MTV. So guess who has almost dictatorial control over radio airplay and MTV? Oh, you guessed! Guess who has reps visiting the major radio stations to ensure what they call rotation play, where their music is put into the cartridges which are played over and over on most music stations? And over.

Guess who has reps visiting the major retail chains to set up point-of-purchase displays, provide posters and so on? It ain't the little indies.

So how can Uncle Wayne throw a monkey wrench in those well-oiled works? It's a big job, so it takes guerrilla attacks on a whole bunch of weaknesses. I call these my WHIRL projects . . . that's We Help Independent Record Labels. I've got 38 of 'em so far, with more developing every week or so.

What do I mean by WHIRL projects? Well, W01 is Indie Info Inc., an indie credit bureau which helps indies find out which distributors pay and which don't. W02 is a monthly publication, *Adventures In Music,* which goes to some 5,000 radio stations to help music directors know what indie music has been released recently, which is selling best and which is getting hot airplay.

Music Retailing

Employee Training

Is DAT Dead?

Will Labels Crack Under Pressure from Censorship Groups?

One-Stop Picks The Hits Announces CD Sampler

CD Pricing:

Where the Money Really Goes

The Relentless Mutants Cash In on a Not New Supergroup

INSIDE THIS ISSUE
Retailer Spotlight page 6
New Products page 10
Dealers' Forum page 14
Music News page 16
Indie Charts page 16
New Releases page 17
Industry News page 34

Longbox Mate You Can Live With! see page 8

W03 is *Music Retailing,* a biweekly publication which goes to about 10,000 record stores to help encourage them to stock and sell indie music. It also provides information on displays, sales training, computer systems, theft prevention and so on.

W04 is our CD Bank, a way for indies to swap their compact discs with other indies and thus keep up with what's been released recently, but without having to buy the CDs at retail price.

SUMMER 1990
M/NH
mail order music service
$1.95
MAIL ORDER CATALOG FOR
POP/ROCK
SOUNDTRACKS
CLASSICAL
ACCESSORIES
WORLD
JAZZ
NEW AGE
RELIGIOUS
FOLK
ORDER FORM

W05 is Music/NH, a mail order indie music service. M/NH runs a catalog ad in *CD Review* every month . . . plus it sends out a mail order catalog. Most record stores don't want to bother stocking indie music . . . doesn't sell fast enough . . . so M/NH makes it available by mail with fast service and a reasonable price. We tried an ad in *73* a couple months back to see if you would buy music. Yep, you will.

Another benefit of M/NH is that it provides a way to pretest the sales of new indie releases. Those which sell well are then recommended to record stores as proven hot titles via *Music Retailing.*

W06 is what we call a Longcard—it's a 6" x 12" card which is packed with sales information. This card is designed to replace the 6 x 12 longbox or blister packs which have been used by the majors to package CDs. These packages cost you $1 to $2 additional and then you throw them away. This is ecologically terrible . . . as well as a huge waste of money. So we're working to get indies to use Longcards instead of longboxes. This makes it so the stores don't have to update their old LP display fixtures. It allows them to display sales cards for many times as many CDs in a smaller floor space and eliminates theft problems.

W07 is a publishing service to help indies produce better liner notes for their music. Most indies are small and don't have the writers, typesetting, artists, photographers and so on it takes to produce good liner notes. We do.

INDIE WORLD

CD Review

How To Win

Schwann Song

A Communications Medium

W08 is *Indie World,* a monthly publication which reaches about 5,000 independent record companies. It helps them keep up with recording techniques and digital technology. It helps them with marketing and industry information.

W09 is Creative Music Marketing, a new distribution system for indie music. CMM will be getting started in 1991 with a completely new approach to distributing music. Participating retailers will set up Indie Music Boutiques and will be able to make five times the normal store profit from these sales. CMM will be distributing the M/NH tested proven sellers.

W10 is Indie Workshops. In 1991 we're planning workshops to help indies with forums on the latest in digital technology, packaging, distribution, price testing and so on. Target cities are Boston, New York, Chicago, Nashville and Los Angeles . . . where indies tend to be concentrated.

SCOTT JOPLIN'S RAG TIME
GREENER PASTURES
Played by Scott Kirby

W11 is Greener Pastures Records, my own record company. By producing and marketing music myself I face the same problems faced by all other indies. This helps me work out creative solutions which I can pass along. GPR has already produced two ragtime releases on CD and cassettes (CS), with some bluegrass coming soon . . . and a lot more ragtime.

W12 is a weekly *CD Review* TV program. Fritz Wetherbee, the humorist on my "How To Speak N'hamsha" cassette, is the producer and the show is being developed for 1991 syndication. This is really going to be fun. We have some great video talents here.

W13 is the same idea, but for radio. This is also scheduled for a 1991 debut.

W14 is a weekly *CD Review* newspaper column. We're looking for the right writer for this one . . . someone who can convey the enthusiasm and humor it'll take to make this a winner. Good writers are not easy to find. We have an overkill of information, so it'll be fun.

CD Guide
Over 45,000 audio CD listings
10,000 quality ratings
New CD-related products section
Music samples . . . Quarterly updates

W15 is the CD-ROM version of our biannual *CD Guide* publication. We're up to over 45,000 CDs listed in the most recent issue. The ROM has the entire list on it, cross-indexed to every review we've ever published. It also has some full color cover pictures and sound samples of many CDs. It's touch-screen operated for use in libraries and larger record stores. This CD-ROM is a quarterly publication.

W16 is our *almost FREE CD Sampler.* The idea is to have one track from each of 16 different indie CDs on each Sampler. The Samplers sell for the crummy $3.49 postage and handling costs, making it possible for people to hear the music indies are putting out . . . something which is difficult to do over the major label controlled radio. We're already moving about 20,000 of these Samplers a month and are gearing up to put out 64 of them a year. These are also being integrated with some later WHIRL projects (22-24-25-28-29).

That's not even half of the projects. We're developing some new ways of selling music . . . through libraries (W24), radio stations (W29), hotels (W25), dance studios (W23), restaurants (W22) and so on. I'll tell you about some of the other exciting projects some other time.

What I wanted to point out is that when you tackle a big job like changing the music industry you can't do it with one little project. I've got a bunch of people here having the time of their lives getting new projects going and building the older ones into bigger businesses.

I'm reminded of the enthusiasm and fun we had back in the early '80s when we had *80-Micro* going strong (third largest magazine in America). We started *InCider* for the Apple, *Run* for the Commodore computers, and a bunch of other magazines and software releases. Our sales were doubling every year . . . and with absolutely no debt!

The same excitement and productivity could be brought to the ARRL, making it a dynamic organization instead of the sleepy bureaucracy we have now. We need teams to be organized to clean up our bands and to get our hobby growing again. We need strong support for all new technologies. We need to make amateur radio come alive so we'll all have more fun.

We need better-run contests . . . and we also need weekends without contests, too. We need awards that are ecologically considerate . . . which don't tend to trash our bands like the present DXCC mess. Our clubs desperately need leadership and guidance. There are far too many that are like old tops . . . still spinning, but running down and near collapse.

Yes, permission is granted to reprint this editorial. You may send copies to your somnolent ham friends. You may publish it in your club newsletter. You may read it over the air.

Docket 90-55

This is the FCC's Communicator proposal. I've submitted a horrendously long reply . . . too long to be printed here. If you'd like to see it send me $5 and I'll make a photocopy for you.

Basically, I oppose sticking all newcomers up on our almost unused (for rag-chewing) UHF bands. I propose, instead, a simplification down to two classes of license . . . for the time being . . . with an end aim of getting us down to only one license class.

How can we get hams to learn more? By making it fun, not by forcing them to memorize Q&As, which are a useless waste of time. You get me some new hams and I'll get them into packet and learning more than they ever thought they would. I'll get them onto OSCAR. I'll get them running around with homemade fox hunting equipment. I'll get them up on 10 GHz. But first I need some new hams to replace the old timers who would rather see our amateur radio bands given to UPS or used for more TV stations than have a no-code license.

Yes, the code is only a tiny part of our problem . . . but it's a critical one. Without no-code I don't think we have a chance. With it, all we have is a chance . . . and then, if you don't give the ARRL an immediate change of directors . . . and I mean this year . . . we're in deep trouble.

If you run into any old "the ARRL can do no wrongers" who get mad at my blaspheming the League, you might clue 'em that one of the directors was sick enough about what's been going on to make a trip and visit me, to make sure I was up-to-date. And you might then ask 'em, okay, let's say that old Uncle Wayne is full of baloney . . . can you argue with any of his recommendations for changes?

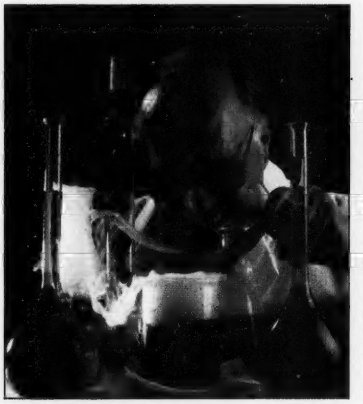
Newsstands Too

I cited the music business as being in need of some big changes to get it out of the hands of a cartel. The newsstand distribution business is just as crooked, screwing small publishers almost beyond belief. Once I have the music business cleaned up a bit, I've got some great ideas for helping small publishers get better newsstand distribution.

The one thing I'm not going to do is set up a new national ham organization in order to save amateur radio from the League directors. It's entirely up to you to do that . . . by cleaning house. It's easy. The directors come up for election every other year, so by late 1991 you can have a brand spanking new League . . . one which can be dynamic and make amateur radio what it should be.

Vote out the turkeys. Vote for directors with practical business experience. Look for people with entrepreneurial experience, people who are used to running businesses and making decisions. Let's stop making the director job an ego trip for old traffic handlers and the ARRL party faithful.

The next WARC is coming fast. Are you going to help President Price fulfill his fantasy of spending maybe a million dollars of your money having a ball in Geneva? If you think ol' Uncle Wayne is baloney again, how about Pete Hoover W6ZH and Bill Orr W6SAI, both as solid longtime ARRL supporters as I've ever seen, and both asking Price to step down?



A Consultant?

If the League isn't able to find someone with my understanding of the field and marketing experience, I'm available for consulting, when I have the time. My modest (almost niggardly) consulting fee will go to the Monadnock Hospital Foundation to help fund the new hospital wing.

Just as the USSR is in need of help with their perestroika (restructuring), I believe the ARRL may need some outside help to cope with their needed changes and restructuring. I'll be glad to help.

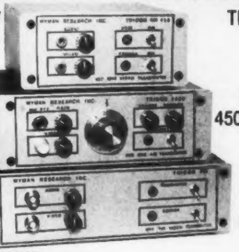
I've been helping the local health services as treasurer and trustee of the Monadnock Hospital Foundation. I'm also chairman of the Strategic Planning Committee, where I'm bringing the health services, day care and nursing homes into an integrated group of services, all tied in with the hospital and satellite medical offices in the surrounding towns. We'll be providing health and health information services, aimed both at keeping people healthy and repairing long- and short-term health problems.

Getting my area of New Hampshire organized as a model of what small town health care should and can be for the next two decades is a great challenge. I love it. So there's where any consulting fees will be invested. This isn't blue sky. The ground-breaking ceremonies for our new $8 million hospital wing were held a few days ago, with completion scheduled for 1991.

So yes, I keep pretty busy for a 68-year-old. I realize, working in the health business, that every day is a crapshoot, with the odds getting worse every day. Will it be a tumor, cancer, stroke, heart attack, a jealous husband or a fall from my scooter? Maybe it'll be a tree when I'm skiing or an embolism when I'm diving? In the meanwhile I'm working every available minute to help Monadnock health planning, to fight the international music cartel, to fix America's broken educational system, and to try and save amateur radio from its old-timers.

Oh, I still manage some time for reading, TV, movies and some trips. Did I mention getting to the Grand 'Ole Opry, when I was in Nashville recently? Or my trip to Sedalia (MO) for the Ragtime Music Festival? Probably.

Sure, I think I could get the ARRL up and moving, doing everything and a half we need to have done . . . and without a lot of expense either. I tend to come up with a scheme for every new project to pay for itself . . . maybe even make some profit. Old hams with a money complex frequently say that old Wayne is doing this or that just to makemoney. Or I'm doing something to get more subscriptions. I can't think of anything I've ever done where money was the main goal. Sure, the more sub-



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1 450 TRANSMITTER
Power output is 3W peak; two independent audio systems (Sub-carrier and On-carrier); 10 pin camera connector on back-BNC or RCA connectors on front; SYNC stretcher for optimum composite video; standard crystal frequency: 439.25 MHz or 434.00 MHz; powers video camera (10 pin connector); requires 13.8V DC at 600 MA plus camera power (1 amp); RF tight aluminum cabinet with brushed aluminum panel; size: 2.2" x 5.25" x 5.5".

2 450 TRANSCEIVER
Power output is 3W peak; 10 pin camera connector on back panel, BNC or RCA connector on front panel; monitor video from camera or detected video output; all new video and audio circuitry with SYNC stretcher; new two channel audio system on transmit; new more powerful video transmitter; standard crystal frequency: 439.25 MHz or 434.00 MHz; .8 dB NF GaAsFET pre-amplifier; RF tight aluminum cabinet with brushed aluminum panel; size: 2.2" x 7" x 5.75"; relay switched antenna.

3 FM TRIDONS Both Have:
Pre-emphasis circuitry; "N" connector; RF tight aluminum cabinet with brushed aluminum panel custom designed by W9YL; cabinet size: 2.2" x 8.2" x 5.5"; requires 13.8V DC at 2 amps; large heat sink.
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Over the last 30 years *73* has pioneered digital communications, solid state, SSB, SSTV, repeaters, NBFM, RTTY, computers, home construction, OSCAR, packet and so on. With your support *73* will go on, helping new technologies be developed. Despite the daily crapshoot, I'm in good shape and expect to be around giving you hell about your failings for many more years.

Look, if wishy-washy weak-willed Wayne Green can take off 85 pounds, so can you! Techs, if poor old dumb Uncle Wayne managed to pass the stupid 13 wpm code test (50 years ago), almost anyone can. Heck, I can pass it again, if you give me about two days to practice, even in my advanced state of mind decay.

That photo of me in my lab? I'm working on a new molecular configuration for impregnating CDs to stop bit-rot. It'll be on the market soon (W38) and it will do everything but the dinner dishes. I'll be looking for sales reps. ■

HAM HELP

Number 36 on your Feedback card

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Thank you for your cooperation.

Wanted: All info on connections for the Digicom 64 board to a Heath HW24HT, and any info on program set-up. Thanks. *G. Ebersole KA3UQJ, 536 New St., Roaring Spring PA 16673.*

Help! I want to get started in amateur radio through the HF bands, but have no money for a rig. Any one of you helping Elmers out there willing to donate any old HF gear to a young fellow like me? Will pay freight charges. *Victor Doplito, 18966 Woodland, Trabuco Canyon CA 92679.*

I need a copy of a schematic/operating manual for a Clegg Mark 3 (it's an old rock-bound 2m rig). *Klaus Spies WB9YBM, 8502 N. Oketo Ave., Niles IL 60648-2006.*

I am trying to contact radio amateurs in the USA who run Commodore computers. I run a computer/radio users group here in the UK and we want to get involved with either individuals or groups who run CBM machines in the USA. *The Commodore Radio Users Group, c/o Simon Lewis GM4PLM, 66 Camperdown Court, Helensburgh, Strathclyde G84 9HJ, England.*

I need interconnect data for wiring a Tandon TM-502 hard disk to its driver card. Willing to pay reproduction and mailing costs. *Ralph Alsmeyer KA1DQ, 1415 Tahoe Ct., Lake Worth FL 33461.*

Wanted: A schematic or service information for a Genave Mobiline I VHF (150 MHz) transceiver with a type Q receiver. I will pay for copy and postage, or will copy and return. *Don Bray WD5DON, 3209 Rodd Field Road, Corpus Christi TX 78414.*

Wanted: Owners manual and schematic for Siltronix LA-650 linear amp. Will pay copy cost or copy and return. Thanks. *H. Sellers, 343 Estep Ln., Waverly OH 45690.* ■

CIRCUITS

Number 37 on your Feedback card

Great Ideas From Our Readers

PTT Time-Out

After several instances of "timing out" my favorite repeater, I designed the following circuit. The heart of this circuit is the 555 timer, a readily available IC capable of long time delays. Using the formula $t = 1.1RC$ (with t in seconds, R in ohms, and C in farads), the length of "maximum PTT" can be calculated (see the table). The values given are for a three-minute timer. Check with your repeater group to find out the time on your local machine.

The 555 is held in the reset mode by holding pin 4 at a logic high through pull-up resistor R1. This ensures that the full time-out period is available at the beginning of each PTT. The low-going PTT signal is passed through the inverter to one input of the AND gate, and also to the MC14538 resettable dual monostable oscillator (operating in the non-retriggerable monostable mode). The NOT-Q output of the MC14538 is used to provide the proper length trigger pulse for the 555, which goes into the set mode and provides the other input for the AND gate. The output of the AND gate is used to turn on Q1, a buffer which keys the transmitter. When the microphone is unkeyed, one input of the AND gate is lost, pin 4 of the 555 goes high and the circuit resets. If the operator is a little long winded, the 555 time period will elapse which will remove its input to the AND gate, causing Q1 to turn off, unkeying the transmitter.

Remember to tie the inputs of unused gates of the 14538 and 4081B to the proper logic levels as shown on the schematic. If possible, place the unit inside the transmitter itself, or mount the unit in a metal box, making liberal use of bypass capacitors. ■

You may reach Klaus Spies WB9YBM, author of this circuit, at 8502 N. Oketo Ave., Niles IL 60648, for PC board or stuffing diagram information.

$T = 1.1\,RC$

T_s	R_Ω	C_f
180	1.6M	100µF
150	1.3M	100µF
120	1.1M	100µF
90	818.2k	100µF

180s = 3 min.
150s = 2 1/2 min.
120s = 2 min.
90s = 1 1/2 min.
(FOR 555 TIMER)

C>100µF TYPICALLY REQUIRES MORE EXPENSIVE LOW-LEAKAGE CAPACITORS.

Table 1. Values for Diverse Duty Cycles

Have a quick'n'easy circuit idea? Share it and get a one-year subscription or extension to *73*! Clearly mark all entries as submissions for Circuits to distinguish them from manuscripts. Send your entries to Circuits, *73 Magazine*, Forest Rd., Hancock NH 03449.

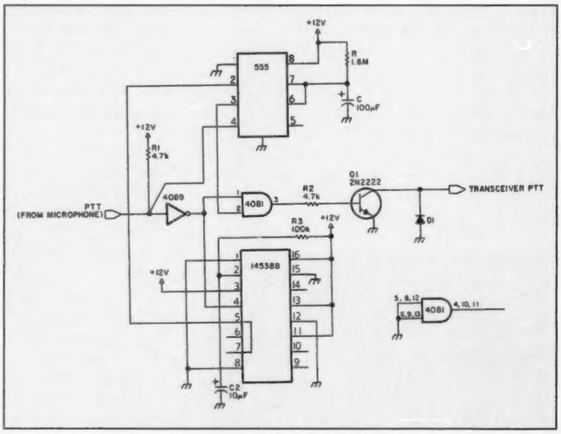

Figure 1. Schematic of the PTT Time-Out circuit.

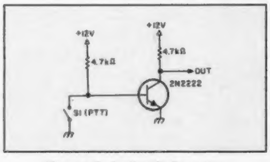

Figure 2. A simple inverter.

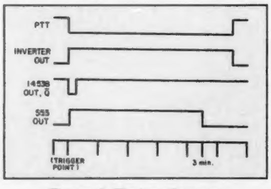

Figure 3. Timing diagram.

GOES 1691 MHz RECEPTION

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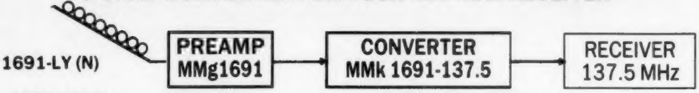

1691-LY (N)	**MMg 1691**	**MMk 1691-137.5**
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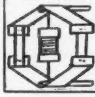

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ARRL Convention

The Southwest Division ARRL Convention is being held in San Diego this month at the Town and Country Convention Center in Mission Valley. This is about ten miles from my home and I plan to be there for all activities. Plans include presentations by Ed Munn W6OYJ, "Introduction and Overview"; Gordon West WB6NOA, "VHF/UHF DXing"; Bill Burns WA6QYR, "Mountaintopping"; Chuck Swedblom WA6EXV, "3 cm Band"; Jack Henry N6XQ "24 GHz"; and Steve Noll WA6EJO, "Lasers." After the main program on Sunday, there will be equipment displays and demonstrations.

If you have built or modified something you're proud of, bring it, and a table will be provided to display it. The presentations are scheduled from 9 a.m. to noon. If you plan to bring anything, contact Ed Munn W6OYJ, 6255 Radcliff Dr., San Diego CA 92122. Tel. (619) 453-4563. The convention runs from Friday, August 24, to Sunday, August 26. Hope to see you there.

Switching Power Supplies

Last month I covered the Linear Technologies switching power supply. This month I have a home-brew version of a similar power supply that you can construct from parts using a standard 110 AC to 24 volt center tapped transformer. Kerry N6IZW came up with the circuit that uses the secondary of a 24 volt transformer to switch the 12 volts DC across at a 60 Hz rate. The primary of this transformer is now used as the output to supply 60 Hz at 110 volts AC. This circuit can be adapted to a toroid for 12–24 volt use as originally intended, but it will have to wait until the proper toroid is found. Here is how the AC transformer works.

As an example, if the transformer is capable of 24 volts at 3 amps, the 110 volt output should be good for about 35 watts. (12 volts switched across half the input times the current rating of 3 amps.) While this might not be completely true due to efficiency and transformer losses, it is good enough for demonstration purposes.

Testing the switcher, we found that small portable TVs and light bulbs of appropriate ratings worked well. I changed the output transformer to one that had a 22 volt, center-tapped winding, current rating 10 amps. Again I used the 110 side of the transformer as the secondary, as before, and I was able to obtain about 120 watts from this transformer. (Dropped input voltage to 11 volts to hold output to 120 volts AC.) I used a solid state RGB computer monitor, a 25 watt fluorescent light, and a small AC fan for the test load. Total run time with all appliances loading the circuit was about an hour and a half. The heat sink that the power FETs were attached to was just warm after one hour of continuous use.

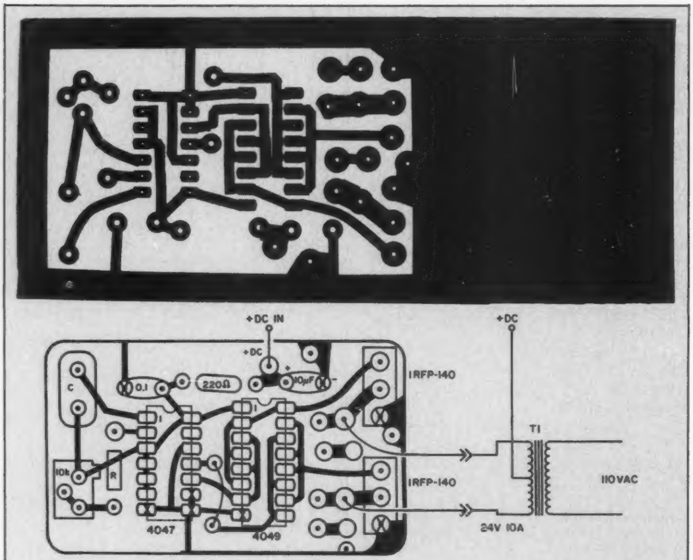

Figure 1. Switching power supply foil pattern and parts placement.

This should demonstrate the benefit of low "on" resistance that these power FETs have. If transistors were used, the heat sink temperature would have been quite high, and I suspect that forced air would be needed to properly cool the heat sink. By the way, the heat sink used was an eight ounce block of scrap aluminum. The FETs were bolted to the heat sink with insulators and a small dab of heat sink grease.

One word of caution about using power FETs. With all power switching circuits, you need to be aware of power supply spikes, noting in this case the FET's drain puncture voltage. The device can be destroyed if this rating is exceeded by the voltage spike on the leading edge of the switching waveform. In the case of the IRFP-140 device, the voltage rating is 100 volts. The spike was observed to be 45 volts on the 120 watt transformer (under load) that I used. Provisions were made to the PC board to add voltage spike suppression components at a later time. This network might be a series resistor diode capacitor network to ground from each drain. I'll keep you informed on new developments as they come up.

Switcher Circuitry

The circuitry for the switcher is very simple and requires only two ICs, a 4047 multivibrator and a 4049 hex inverter. The frequency of the 4047 multivibrator is set by an RC constant using a 37.8k resistor and a 0.1 µF capacitor for 60 Hz operation. The actual resistance is made up of a ¼ watt resistor and a series 10–20k potentiometer, which gives a range for fine frequency adjustment. Originally the power switcher was to be used for a 12 to 24 volt toroid type supply. When suitable toroids become available, I'll construct it. For 40 kHz switching, operating with a toroid, you'd change the 0.1 µF capacitor to 400 pF, and the resistor total to 14k; for 60 kHz, you'd change the resistor to 9.46k.

To calculate your own RC values, use the following formula: Period = 4.4 x (R x C), with resistance in ohms and capacitance in farads. The period is converted to frequency by dividing it into 1. For example, using a 0.1 µF capacitor and a 37.8k resistor: Period = 4.4 x (37,878 ohms x 0.0000001 farad), which equals 0.01666632; 1 divided by 0.01666632 = 60.00124803 Hz. As per the example above, that would equate to a 20k pot and 18k fixed resistor with a 0.1 µF capacitor. This would give sufficient range to trim frequency.

The switcher circuit pc board pattern is shown in Figure 1 with parts placement indicated in Figure 2. Don't let the simplicity of this circuit fool you; it works very well, considering that it uses fewer than a dozen components. You can easily duplicate the circuit with other power FETs. The PC board is not necessary, just a refinement. If you can't locate a supply of FETs (the only key component), I will provide a mini-kit with PC board (ready to drill), a pair of power FETs (surplus), and a few other parts for $15, or only a pair of FETs for $5. All costs postpaid U.S.

This power supply is not limited to just 12 volts input. Depending on your transformer selection, it could be any other voltage for your application. Just don't exceed good engineering practices, trying to push ratings too high, and you will be OK.

These power FETs provide many different design applications to ponder. If higher currents are needed in your application, the power FETs can be paralleled directly without equalizing resistors. FETs are basically degenerative with respect to temperature. As the temperature increases, internal resistance increases, which limits device current. This means that FETs can be paralleled without equalizing resistors, as they will share the load and shift current as a natural function of the device. This is in sharp contrast to power transistors. As transistor current increases, so does temperature, until thermal runaway and destruction. For power FET information, contact International Rectifier, 233 Kansas St., El Segundo CA 90245.

Publication Information

Recently I was made aware that *VHF Communications,* a magazine devoted entirely to VHF/UHF and microwave communications, is now available in the US. A product of West Germany, it's a source of excellent articles translated to English. Being totally devoted to microwave topics, the articles go into great detail and have full-size layouts and photos for easy duplication of the projects and activities going on in Europe.

Several years ago, Red W6BLK first introduced me to this magazine, but I lost track of it until recently. TimeKit, PO Box 22277, Cleveland OH 44122, tel. (216) 464-3820 is the U.S. distributor for this quarterly publication. Subscription cost is $20.95 per year.

Mailbox Comments

Bill in Linden, New Jersey, wants to know how to connect and calibrate his frequency counter using WWV with his Realistic DX-300 receiver. Well, Bill,

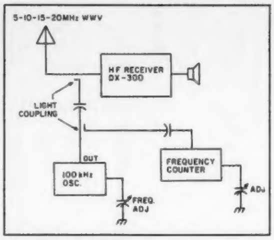

Figure 2. Frequency counter calibration using WWV and 100 kHz oscillator as a transfer standard: a) Zero beat WWV with BFO on in receiver (use WWV quiet period); b) Turn on 100 kHz oscillator and adjust the circuit (oscillator calibration) to agree with WWV zero beat on receiver; c) Measure 100 kHz frequency on counter, adjusting the counter's time base crystal to display 100 kHz exactly.

the simplest way to do the job would be to hook up an external 100 kHz crystal and couple it to both the receiver and frequency counter. Tune the receiver to zero beat (BFO on) using WWV on 5, 10, or 15 MHz, (quiet period for zero beat), then turn on and adjust the 100 kHz crystal oscillator for a comparison zero beat.

> ***". . . bring your frequency counter back into calibration. Expect accuracy to 1 Hz or possibly 0.1 Hz per MHz."***

When the oscillator is adjusted to zero beat with WWV, measure its frequency on your counter. This method is now using the 100 kHz oscillator as a transfer standard. Now if there is an error on the counter (during perfect zero beat), correct it by adjusting the frequency counter time base until the counter display reads exactly 100 kHz. This should bring your frequency counter back into calibration. Expect accuracy to 1 Hz or possibly 0.1 Hz per MHz with most small counters. See Figure 3 for details.

Konrad in Palmdale, California, is a photographer and wants to know how the railroads use microwave for communications. He monitors VHF to determine when older engines and equipment are coming down the track, since he wants to photograph this older equipment. Well, Konrad, I don't believe they are using microwave directly to their mobiles and equipment. What they are doing is using the microwave system much like the telephone companies use it—for normal telephone communications, except that theirs is a closed system. This enables the railroads to process repeater communications from almost any part of the country to one of several central control points for co-ordination.

Some of these companies sell the extra channel space on their microwave systems, just like the telephone companies do. There is no way to monitor these microwave frequencies without costly demultiplexing equipment. Normal telephone microwave involves many channels, all of them operating on one microwave frequency. Large systems use from 600 to 1860 channels per microwave. A small system could be just 60 channels. Five basic 12-channel groups are combined into a "super group" to make 60 channels. Ten super groups combine to make a "master group" of 600 channels stacked in a frequency progression, each one of them carrying on multiple operations on at the same time without interference. See Figure 4 for a typical multiplexing scheme that feeds one microwave transmitter as its baseband signal.

Because of this multiplexing scheme, it would take expensive equipment to demodulate the microwave signal, not to mention the federal legal aspects involved. There are even state statutes that apply to police scanner operations, so check out your local laws to be aware just what is involved. If you do use a VHF scanner don't be disappointed comparing performance to commercial equipment. The commercial equipment gets its high performance from sensitivity and immunity to overload interference. Most scanners available on the market are not comparable and do overload or are desensitized in the presence of strong signals.

Frank WØNRI in Evergreen, Colorado, states that he has a hearing loss similar to mine. (He can't operate next to a blower motor on amplifiers, either.) He was very interested in the column on conduction power amplifier tubes, and is on the lookout for tubes similar to the 4CS250SRs, as he wants to convert an existing power amplifier. Let us know developments, Frank, as your project nears completion.

John K2SMZ sent me a copy of the very fine newsletter *Cheese Bits*. This is a product of the Mt. Airy "Pak rat's" VHF Club in Philadelphia, Pennsylvania. Club meetings are on the third Thursday of the month at the Southampton Free Library, 947 E. St. Rd., Southampton PA 19866. Thanks, John.

Glen, from Cleveland, Ohio, has questions about using a Solfan-type of Gunn oscillator mount with an additional 18 GHz oscillator focused into the same antenna. He is wondering what kind of switching would be needed to select either oscillator for local use. I believe that by keeping it simple, no switch would be required. Both frequency sources are mounted at the focus of the dish, and you only have to reposition the dish to focus it for each different unit. Now switching is simply the position of the dish and DC power switched to the oscillator desired.

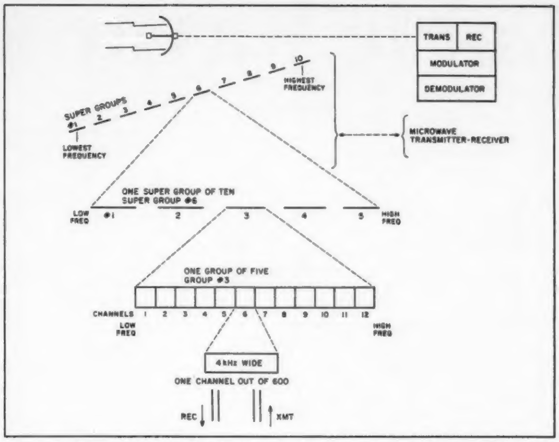

Figure 3. Frequency stacking for microwave transmission. Each group, subgroup, is modulated together by a progressively higher frequency local oscillator to stack 600 voice channels into one microwave transmitter/receiver (full duplex voice).

Larry VE2YU wants to know if the preamp board is available for the project in "10 GHz Fun," my article in the April 1990 issue. Yes, it is, and comes with the kit, as stated in the article. Except for the ferrite rods for the low frequency calibration antenna, all kits previously mentioned are available. I still have plenty of VN-10KM FETs, but the local surplus store sold all the remaining rods before I could pick up a second batch.

As always, I will be glad to answer any questions pertaining to microwave or related topics. For a prompt reply please send an SASE. 73, Chuck WB6IGP. 73

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05H24 • **Radio Handbook, 23rd Ed.** *William I. Orr W6SAI*
840 pages of everything you wanted to know about radio communication. Indepth study of AC/DC fundamentals, SSB, antennas, amplifiers, power supplies, and more.
$29.50 hard cover only

03R01 • **World Press Services Frequencies (RTTY)**
by Thomas Harrington W8OMV
A comprehensive manual covering Radioteletype news monitoring—contains all information—antenna, receivers, terminal units, plus three extensive frequency lists. Covers 65 World Press Services broadcasting in English. "The Original Press Book." 84 pages. **$8.50**

AR0477 • **Low Band DXing**
How to meet the challenges of the different forms of 160, 80, and 40 meter propagation with effective antennas, equipment, and operating strategies. **$10.00**

AR2030 • **Your Gateway to Packet Radio 2nd Edition**
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AR2171 • **Hints and Kinks**
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The latest information on OSCARs 9 through 13 as well as the RS satellites. Information on the use of digital modes, tracking, antennas, RUDAK, microcomputer, and more! **$5.00**

AR0046 • **Satellite Experimenters Handbook**
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AR2898 • **Space Almanac**
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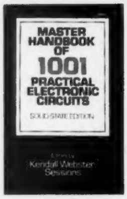
Extraordinary book. Captures the breathtaking recent news from space. Includes about 40 pages on Amateur Radio satellites. Find almost anything you might want to know about man's trip to the stars. 960 pages. **$20.00**



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Compiles issues 1 through 20 of the RTTY Listener Newsletter. Contains up-to-date, hard-to-find information on advance RTTY and FAX monitoring techniques and frequencies. 156 pp. **$19.95**

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This book will guide you step by step through the complexities of making simple repairs to your Commodore 64. **$19.50**

05C16 • **C64/128 Programs for Amateur Radio & Electronics** *by Joseph Carr*
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01A87 • **The Shortwave Listener's Antenna Handbook** *by Robert J. Traister*
If readers are looking for ways to beef up their shortwave reception capacity and increase listening enjoyment, this handbook can show how to accomplish it easily and inexpensively. **$12.00**

12E76 • **Basic Electronics**
Prepared by the Bureau of Naval Personnel
Originally prepared for Naval Training courses and thoroughly revised in 1972—now essentially a new book. Cover the important aspects of applied electronics and electronics communications.
567 pp. **$10.95**

12E41 • **Second Level Basic Electronics** *Prepared by the Bureau of Naval Personnel*
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10M44 • **World Atlas**
by Radio Amateur Callbook Inc.
20 pp. of full color, 8¾" x 10⅞", contains North Polar projection of the world; maps of all seven continents, West Indies/Caribbean area, and Pacific Ocean. **$5.00**

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by Rudolf F. Graf/ George J. Whalen

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by Dave Ingram K4TWJ

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02C30 • **The Commodore Ham's Companion**
by Jim Grubbs K9EI

160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! **$9.50**

03M221 • **US Military Communications (Part 1)**

Deals with US Military communication channels on shortwave. Covers frequencies, background on point to point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. 102 pages. **$12.95**

03M222 • **US Military Communications (Part 2)**

Covers US Coastguard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. 79 pages. **$12.95**

03M223 • **US Military Communications (Part 3)**

This part completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. 78 pages. **$12.95**

15D90 • **1990 Shortwave Directory 6th Edition**
by Bob Grove

An excellent reference for North American shortwave listeners, this DXer's bible is crammed with up-to-date, accurate frequency and user information from 10KHz to 30KHz **$19.50**

10A343 • **All About Cubical Quad Antennas**
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The "Classic" on Quad design, theory, construction, operation. New feed and matching systems. New data. **$9.50**

10A344 • **The Radio Amateur Antenna Handbook**
by William Orr W6SAI/ Stuart Cowan W2LX

Yagi beam theory, construction, operation. Wire beams. SWR curves. Matching systems. A "must" for serious DXers. **$11.50**

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All New! Low-cost, multi-band antennas; inexpensive beams. "Invisible" antennas for hams in "tough" locations! New data. **$11.50**

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DX propagation, VHF Yagi and Quad beams, repeaters and how they work, OSCAR satellites and how to use them. **$11.95**

16A24 • **Vertical Antenna Handbook, 2nd edition**
by Paul H. Lee N6PL

A classic. Reprinted with updates, including an addendum on antenna design for 160 meters. Also, feeding and matching, short verticals, ground effects, and more. 139 pages, paperback. **$9.95**

09V11 • **The Basic Guide to VHF/UHF Ham Radio**
by Edward M. Noll

This book provides a first rate introduction to life on the 2.6 and 1.25 meter bands as well as 23, 33, and 70 CM. **$6.50**

04M54 • **GGTE Morse Tutor**

Floppy disk for IBM PC, XT, AT, and compatibles. Learn the International Morse code or improve your capabilities. One diskette will take you from beginner through extra class in easy self-paced lessons. Standard or Farnsworth mode. Code speeds from 1 to over 100 words per minute. **$19.50**

05E94 • **Crash Course in Electronics Technology**
by Louis E. Frenzel Jr.

With a proven format of programmed instruction, this book teaches you the basics of electricity and electronics in a step-by-step, easy-to-understand fashion. **$21.50**

01B033 • **Talk To The World: Getting Started in Amateur Radio** *by James P. Dux K3JD and Morton Keyser N3MK*

Provides information and practical tips on obtaining a novice license. Authors take the mystery out of technical and procedural aspects of ham radio. **$11.50**

09S42 • **The Scanner Listener's Handbook**
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Get the most out of your scanner radio. Covers getting started, scanners and receivers, antennas, coaxial cable, accessories, computer controlled monitoring, more. **$14.95**

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Covers schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. Detailed Press Agency Portraits. 120 pp. **$12.95**

05P67 • **Mastering Packet Radio: The Hands-on Guide** *by Dave Ingram K4TWJ*

Packet radio is the hottest, most rapidly expanding area of amateur communications. Written for the amateur enthusiast, mastering Packet Radio will put you on the cutting edge of this digital communications revolution. **$12.50**

11T88 • **Tune in on Telephone Calls** *by Tom Kneitel K2AES*

Formatted as a frequency list with detailed description of each service and its location in RF spectrum. Provides basic information for casual listeners getting started and details for ardent enthusiasts. **$22.50**

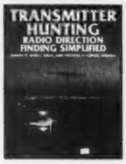
09P33 • **The Pirate Radio Directory 1990 Edition**
by George Zeller

Contains data on some 100 pirate stations active during 1989. How to tune in pirate broadcasts and get QSLs from the stations. **$7.95**

THE WORLD $4.00

73 Magazine's DX Map of the World

How can the World's Best DX Map cost only $4.00? Obviously, a serious blunder which you should take advantage of before we discover it. This is the only world map in black and white so you can color in the countries as you work them! Further, it has almost all of the official IARU 400 countries on it, which no other map at any price has.



01T01 • **Transmitter Hunting: Radio Direction Finding Simplified**
by Joseph D. Moell K0OV and Thomas N. Curlee WB6UZZ

336 pages, 248 illusts. **$17.50**

03K205 • **Guide to Radioteletype (RTTY) Stations**
by J. Klingenfuss

Updated book covers all RTTY stations from 3MHz–30MHz. Press, Military, Commercial, Meteo, PTTs, Embassies, and more. 105 pp. **$12.95**

15S003 • **Communications Satellites (3rd Edition)**
by Larry Van Horn

Chapters on channelization band plans, transponder identification, international satellites, more. **$7.00**

07A66 • **Aeronautical Communications Handbook**
by Robert E. Evans

Exhaustive, scholarly treatment of shortwave aeronautical listening. Well organized, up-to-date. 266 pp. **$19.95**

07R20 • **A Radio Journal 1912–1940**
by Russ Rennaker W9CRC

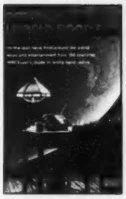
A facinating trip through time. Easy to read and informative, educational and entertaining. A trip down memory lane to the early days of radio. **$7.95**

20M090 • **Computing Across America**
by Steven K. Roberts N4NRVE

Roberts has written articles for *73 Magazine* about the technical aspects of his US tour on his recumbent bicycle. Covers his adventures, people he met, and places he saw. If your lifestyle seems a little confining, read this book. **$9.95**

03S04 • **The Hidden Signals on Satellite TV**
by Thomas P. Harrington and Bob Cooper Jr.

New book shows and tells how to tune in the many thousands of Telephone, Data, Telex, Teletype, Facsimile Signals on most of the TV Satellites, covers equipment, hookups, where to tune. Only book covering these secret signals on the satellites, plus all subcarriers. 234 pp. **$19.50**



06S57 • **1990 Passport to World Band Radio**
by International Broadcasting Services, Ltd.

You can have the world at your fingertips. You'll get the latest station and time grids, the 1990 Buyer's Guide and more. 384 pages. **$14.50**

01P68 • **Pirate Radio Stations: Tuning Into Underground Broadcasts** *by Andrew R. Yoder*

While it may be illegal to operate a pirate station, there aren't any laws against listening to one. Comprehensive guide to tuning in, identifying, and contacting the most unpredictable stations on the radio spectrum. 192 pp. **$12.50**

01A70 • **Practical Antenna Handbook** *by Joseph J. Carr*

Will help you design, build, modify, and install your own antennas. Carr, a 20-year veteran of technical writing, has a unique ability to present complex technical concepts in an easy-to-understand way. 416 pp. **$21.50**

11F52 • **Ferrell's Confidential Frequency List**
Compiled by A.G. Halligey

All frequencies from 4MHz–28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more. 376 pp. **$19.50**

CODE TAPES

One answer to the no-code brou-ha-ha is to make the code so simple to learn that it's a non-problem. Herewith the world's easiest code course—tens of thousands of hams have gotten their licenses this amazing new shortcut way. It's failure-proof. Most people are able to whip through the Novice test after spending less than three hours each on Genesis and The Stickler. People who have given up on other code courses find this one does the job in a jiffy. Going after your General? It's about time. Use the Back Breaker and you'll be there before you know it. A week should do it. Warning, 20wpm code almost invariably appears to cause irreparable, irreversable, permanent brain damage. Uncle Wayne accepts no responsibility whatever for anything that happens to those who are foolish enough to use the Courageous 20wpm tape.

73T05 **"Genesis"** **$5.95**
5 wpm—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

73T13 **"Back Breaker"** **$5.95**
13+ wpm—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

73T06 **"The Stickler"** **$5.95**
6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

73T20 **"Courageous"** **$5.95**
20+ wpm—Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run: You'll wonder why the examiner is sending so slowly!

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NOTES FROM THE ELK

Bill Brown WB8ELK

Special ATV Issue

In this issue we highlight a facet of amateur radio that has really excited me for many years: Fast-Scan Amateur Television, commonly known as ATV. I was in high school when I found out I could actually operate my very own television station from my house. I immediately tore apart my parents' UHF tuner and modified it to tune in the two active ATV stations in town. Even though this was shortly after the first TV signal had been sent back to Earth from the Moon, I think I was more thrilled to see Dan W8PXU and Bob W8RSK waving at me on our old 1960s' TV.

Back then the hardest part was finding a source of video to transmit. Things have changed dramatically over the past few years! With the advent of inexpensive VCRs, camcorders, surplus security TV cameras and home computers, today's ATVer can choose from all kinds of video sources. With several sources of commercially available ATV equipment, you no longer have to be an electronics genius to join in the fun.

Add the dimension of sight to your amateur radio communications! Have a problem with getting a computer program to run? Maybe you need some help with troubleshooting a piece of equipment. Think of how much easier it would be to show your friend the program or your sick rig directly on his TV set!

There are many different facets of ATV operations. DXing (the world record is over 1000 miles on the 70cm band), experimenting with the latest video circuitry, showing off your latest computer programs, public service (parades, special events and emergency communications) and, of course, just sitting back watching each other hamming it up on TV! Don't wait another 20 years for the real-time videophone—it's here now in the form of ATV.

New Heights for Amateur Radio

It only takes a few rides in a private airplane or hot air balloon to get hooked on flying. Unfortunately, these opportunities are fairly rare and costly. If only there was a way to see this view more often. How about rigging up an R/C aircraft with ATV? Imagine being able to fly along with your R/C model . . . put yourself right in the cockpit and really experience the excitement of flying from the safety of your hamshack. All thrills and NO chills! This issue of *73* highlights what can be done with R/C aircraft and rockets. I've taken this idea one step further to send my ham station right on up to the edge of space with weather balloons, resulting in one whale of a ride. It's quite an experience to parachute 20 miles back to earth, all the while knowing that your feet are on solid ground!

Getting Started on ATV

The best way to get involved is to find some local ATVers to demonstrate their station setups for you. Check into the weekly ATV net on 3.871 MHz each Tuesday night between 8 and 9:30 p.m. We'll be glad to help you out. If you know of local ATV activity you may be able to tune in with just a cable-ready TV or VCR, as long as you have an outside antenna. It turns out that cable Channels 57 through 60 coincide with our ATV frequencies on the 70cm band.

The following list should help you find out more about ATV and available equipment:

ATV Publications

ATVQ (Amateur Televison Quarterly), 1545 Lee St., Suite 73, Des Plaines IL 60018. Phone: (708) 298-2269.

CQ-TV (British Amateur Television Club) Dave Lawton G0ANO, "Grenehurst," Pinewood Road, High Wycombe, Bucks., England HP12 4DD. The U.S. agent for membership/subscriptions is Wyman Research Inc., R.R. #1, Box 95, Waldron IN 46182. Phone: (317) 525-6452.

SPEC-COM Journal, P.O. Box 1002, Dubuque IA 52004-1002. Phone: (319) 557-8791.

VHF Communications (German publication that has quite a few ATV articles), UKWberichte, Jahnstr. 14, Postfach 80, D-8523 Baiersdorf, West Germany 9133 47-0. The U.S. agent is Timekit, P.O. Box 22277, Cleveland OH 44122. Phone: (813) 953-4506.

ATV Manufacturers

AEA, P.O. Box 2160, Lynnwood WA 98036. Phone: (206) 775-7373. Manufactures ATV transceiver model FSTV-430A and associated antennas.

Communications Concepts, Inc., 121 Brown St., Dayton OH 45402. Phone: (513) 426-8600. ATV downconverter kits.

North Country Radio, P.O. Box 53-A, Wykagyl Station, New Rochelle NY 10804. Phone: (914) 235-6611. Send an SASE for a catalog covering a variety of video related projects, including two ATV transmitter kits.

P.C. Electronics, 2522 Paxson Lane, Arcadia CA 91007-8537. Phone: (818) 447-4565. One of the longest-standing ATV manufacturers. They offer a large selection of ATV modules as well as complete transceivers and antennas.

T.D. Systems, 2420 Superior Dr.'B', Pantego TX 76013. Phone: (817) 861-5864. Produces a high-quality lineup of mast-mountable AM and FM ATV modules operated by a control system in the shack.

Wyman Research, Inc., R.R. #1, Box 95, Waldron IN 46182. Phone: (317) 525-6452. ATV transceivers, receive converters, transmitters; also carries a lineup of FM ATV systems.

A number of other companies offer antennas, amplifiers, and accessories suitable for ATV. With this kind of manufacturer support we may gain quite a few newcomers to ATV in the near future. Hope to SEE you real soon!

Number 35 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson AZ 85541

Good to Excellent DX

The first two weeks of the month are expected to be very good for radio propagation on the HF bands from the early morning to the late evening hours.

The usual summer static on the lower HF bands will prevail, but in general you can expect good to excellent DX conditions on all HF bands. The last two weeks of the month, however, are likely to be disturbed, with only fair to poor DX conditions on many days.

The worst days, with the greatest ionospheric and atmospheric upsets, will occur on or around August 19-20, 25, and 30.

On August 6, the moon will be full, with a partial lunar eclipse visible from S.W. Alaska, the Pacific Ocean, Antarctica, South and East Asia, and Australasia.

As always, listen to WWV at 18 minutes after each hour for current updates on trends and conditions. The bands at this time of year will be making their transition from summer to fall conditions, and will generally be improving each day toward September. This period, of course, is the prime time for DXpeditions, so anyone interested in rare DX ought to have a ball in August. Keep a sharp lookout for unusual callsigns.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	20	20	—	—	20	20	—	—	—	—	20
ARGENTINA	15	20	20	—	—	—	—	—	—	10	10	15
AUSTRALIA	15	20	20	20	—	40	20	—	—	—	—	10
CANAL ZONE	15	20/40	20/40	20/40	—	20	10	10	10	10	10	15
ENGLAND	40	40	40	—	—	—	15	10/15	10	10/15	15/20	20
HAWAII	15	15	20	20	40	—	20	—	10(1)	10(1)	10	10/15
INDIA	20	—	—	—	—	—	15	15	—	—	—	—
JAPAN	—	20	20	—	—	20	20	—	—	—	—	20
MEXICO	15	20/40	20/40	20/40	—	20	10	10	10	10	10	15
PHILIPPINES	—	—	20(1)	—	—	20	15(1)	10(1)	—	—	—	15(1)
PUERTO RICO	15	20/40	20/40	20/40	—	20	10	10	10	10	10	15
SOUTH AFRICA	20	—	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	—	—	20	20	20	—	—	15	15	—	20	20
WEST COAST	20	20/80	20/80	40	40	40	10	10	10	10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10(1)	20	20	20	—	—	20	—	—	—	15	10/15
ARGENTINA	15	15	20	20	—	—	—	10	—	10	10	10
AUSTRALIA	10	15	20	20	20	20/40	20	20	—	15(1)	10	10
CANAL ZONE	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	—	15	10(1)	15	20	20
HAWAII	10/15	15	20	20/40	20/40	20/40	20(1)	—	—	10	10	10
INDIA	15(1)	20(1)	—	—	—	—	20(1)	15(1)	—	—	—	—
JAPAN	10(1)	20	20	20	—	—	20	—	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
PHILIPPINES	10(1)	—	20(1)	—	—	—	20(1)	15	15	—	—	10(1)
PUERTO RICO	15	20/40	20/40	20/40	—	—	10	10	10	10	10	10
SOUTH AFRICA	—	—	20	—	—	—	—	—	10	10	15	20
U.S.S.R.	—	—	20(1)	—	—	—	—	15(1)	15(1)	20	20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	10/15	—	20	20	20	20(1)	20	—	—	—	10/15
ARGENTINA	10	15	20	20	20	—	—	—	10	—	10	10/15
AUSTRALIA	10	10	15	20	20	20/40	40	20	20	—	10	10
CANAL ZONE	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	15	20	20
HAWAII	10	15	15	20	20/40	40	40	—	15	15	—	10
INDIA	15(1)	15(1)	20(1)	—	—	—	—	20(1)	15(1)	—	—	—
JAPAN	10	10/15	—	20	20	20	20(1)	20	—	—	—	10/15
MEXICO	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
PHILIPPINES	15	—	—	20	20	20	20	20	20	20	20	15
PUERTO RICO	15	15	20/40	20/40	20	—	—	10/20	10	10	10	10
SOUTH AFRICA	20	20	20	20	—	—	—	—	10	10	15	20
U.S.S.R.	—	—	—	20(1)	20(1)	—	—	20(1)	15(1)	15(1)	20	20
EAST COAST	20	20/80	20/80	40	40	40	10	10	10	10	10	15

Note (1) Possible on some days
Use 10 for 10 & 12 meter bauds, use 15 for 15 & 17 meter bauds, use 40 for 30 & 40 meter bauds Where 2 bauds are shown, try both This data is for the highest possible frequency to be used of a given path (MUF)

AUGUST

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 G
5 G	6 G	7 G	8 G	9 G	10 G	11 G
12 G	13 G	14 G	15 G	16 G-F	17 F-P	18 P
19 P	20 P	21 P	22 P-F	23 F	24 F-P	25 F-P
26 F-G	27 G-F	28 F-P	29 P	30 P	31 P	

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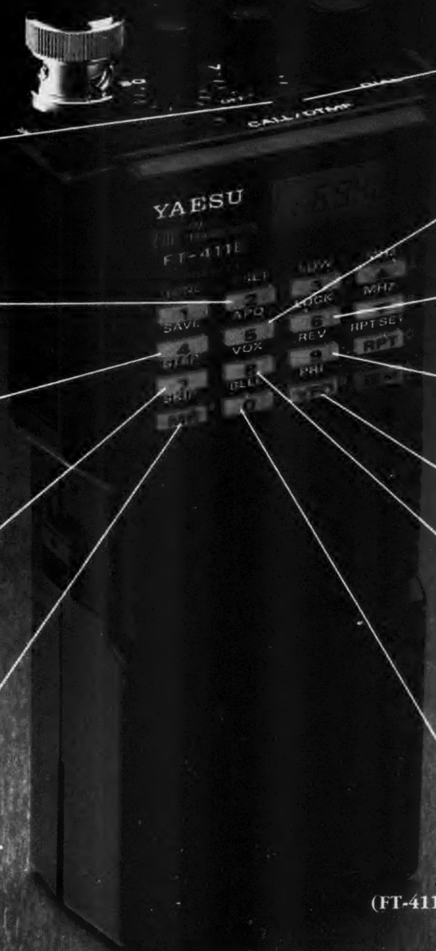
FT-411

(ENHANCED)



INDUSTRY FIRST

One-touch instant recall of favorite channel

INDUSTRY

Built-in PL encode/decode

INDUSTRY

10 battery saving sampling rates

INDUSTRY FIRST!

Programmable channel steps (5, 10, 12.5, 20, 25)

INDUSTRY FIRST!

User friendly for those with impaired vision. Keys have their own distinctive tone.

INDUSTRY FIRST

10-memory auto dialer

INDUSTRY FIRST

APO (Automatic Power Off)

INDUSTRY

Backlit keypad & display

INDUSTRY

PTT/keypad lock

INDUSTRY FIRST

2 VFO's

INDUSTRY FIRST!

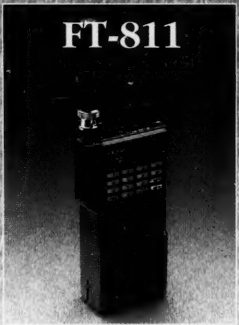
Built-in VOX at no charge

INDUSTRY FIRST!

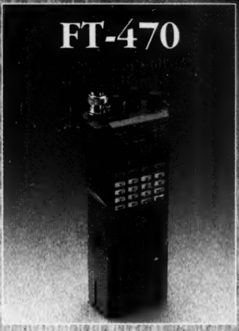
Built-in CTCSS paging

(FT-411E shown actual size.)

FT-811



FT-470



New **FT-911**

For more information on these and other Yaesu products, contact your nearest Yaesu dealer now.

YAESU

Performance without compromise.℠

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TONE
DTSS
MUTE

TM-941A

TRI-BAND FM Transceiver

Kenwood brings you yet another breakthrough — the TM-941A *TRI-BAND* FM TRANSCEIVER. Now you can operate on *three* bands — 144, 450, or 1200 MHz — with one radio! This rig even gives you full duplex, cross-band, triple-band repeat!

- **High power output.** 50 W on 144 MHz, 35 W on 450 MHz, and 10 W on 1200 MHz. (Selectable low power: 5 and 10 W, 1 W on 1200 MHz.)
- **Wide band receiver coverage.** 118-174, 438-450 (400-475 after modification), 1240-1300 (1210-1330 after modification) MHz. TX on Amateur bands only. Modifiable for MARS/CAP. Permits required.
- **CTCSS encode/decode built-in.** 38 sub-tones selectable from the front panel.
- **Cross-band repeat function.** Selectable single or dual input! Offset function on output, allows simplex to repeater repeat!
- **Simultaneous tri-band receive.** Individual volume and squelch controls help you "sort out" the signals.
- **Detachable front panel.** Use the optional PG-4K or PG-4L to mount the front panel remotely.
- **Selective calling option (DTU-2).** Selectively call a single station,or call a group with DTMF tones.
- **303 memory channels.** Store everything you need for efficient operation. All channels allow you to store "odd split" repeaters.
- **Versatile scanning functions.** Band scan, memory scan and programmed scan with carrier or time operated stop.
- **NEW! Auto memory scan.** Automatically memorizes a busy frequency while scanning the band!
- **Automatic repeater offset on 2 m.** Plus or minus 600 kHz for 144 MHz, ±5 MHz on 450 MHz, and ±12 or 20 MHz for 1200 MHz. (Manual offset for 450 and 1200 MHz.)
- **Fixed detect output.** For packet operators!
- **Multi-function DTMF mic supplied.**
- **Auto power off and time-out timer.**
- **4-step dimmer control.** Selectable 4-step dimmer control.
- **Three separate antenna and speaker connectors.** For maximum performance.

Optional Accessories:
● **DTU-2** Digital paging (DTMF) unit ● **PG-4K, PG-4L** Front panel cable kits ● **MC-45** Multi function mic. ● **MB-11** Extra mounting bracket ● **SP-41, SP-50B** External mobile speakers ● **PG-3B** DC line noise filter ● **PS-430** Power supply ● **PG-2N** DC power cable.

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features, and prices are subject to change without notice or obligation.

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